संपर्क

परिसंवाद

त्रैमासिक शोध-पत्रिका

अन्तर्राष्ट्रीय संगोष्ठी

काशीकथा - 2016

"21वीं सदी में काशी"

शुरूआत हो जाती है। उसे पेट पालने हेतु जमींदार के यहाँ नौकरी करनी पड़ती है। यह विडम्बना है कि पिता के हत्यारों द्वारा वह नौकर रख लिया जाता है। उसे भोजन के लिए तरसते रहना पड़ता है। अपने जनवादी विचारों के लिए प्रसिद्ध नागार्जुन ने हमेशा ही शोषक जर्जर मान्यताओं तथा वर्ग व्यवस्था पर प्रहार किया है। 'बलचनमा' उपन्यास में फूलबाबू, राधाबाबू आदि आजादी की लड़ाई में भी शासक वर्ग के साथ थे। बलचनमा को पता था कि अंग्रेजों के जाने के बाद शासक के तौर पर ये बाबू लोग ही गरीबों का शोषण करेंगे। जब फूलबाबू के पास परिवार की शिकायत लेकर जाता है तो अपने परिवार के किये गये अत्याचारों पर उनमें वैराग्य जाग जाता है। समझदार बचलनमा भविष्य का चेहरा साफ–साफ देख पा रहा था।

इस पूरे उपन्यास में लेखक बचलनमा के संघर्ष के साथ खड़े नजर आते हैं। बचलनमा के मालिक न केवल उसका शोषण करते हैं बल्कि माँ–बहन के प्रति भी अच्छे विचार नहीं रखते। बलचनमा के साथ खड़ा लेखक उसे इस सड़ी व्यवस्था के प्रति विद्रोह करने को जागृत करता है। किसान जीवन के संघर्ष के साक्षी नागार्जुन स्वयं भी इस सच से वाकिफ थे कि श्रमिक वर्ग को छला जा रहा है। नागार्जुन ने आजादी के बाद हुए सत्ता परिवर्तन को आईना दिखाने का काम किया है। शासकों की जनशोषक भूमिका का पहचान कर उन्होंने उस पूरे षड़यंत्र चक्र को बेनकाब करने की कोशिश की है।

'बाबा बटेसरनाथ' में नागार्जुन ने गाँव की कई पीढ़ियों की सामाजिक राजनीतिक गतिविधियों तथा उत्थान–पतन को एक वटवृक्ष के मानवीय प्रतिरूप के माध्यम से व्यक्त किया है। 'बाबा बटेसरनाथ' में आंचलिक जनजीवन का यथार्थ अपने सहज स्वाभाविक रूप से अभिव्यक्त हुआ है। आंचलिक जीवन के बिम्ब सजीवता के साथ उकेरता यह उपन्यास वैविध्य और समग्रता की दृष्टि लिये है। कई पीढ़ियों की कहानी कहते उस बरगद को जैकिसुन के परदादा ने लगाया था। पीढ़ियों के यथार्थ का साक्षी यह वृक्ष अकाल, बाढ़, चंपारन सत्याग्रह देख चुका है। इस उपन्यास में कोई केन्द्रित कहानी नहीं है। मिथिला का जनजीवन चार पीढ़ियों के इतिहास और यथार्थ को साथ लेकर चलता है। 'बाबा बटेसरनाथ' यह सारी कहानी जैकिसुन अपने युवा साथियों के साथ मिलकर कांग्रेस शासन को साम्यवादी दल की सहायता से परास्त करता है। इस प्रकार नागार्जुन के उपन्यास युवा चेतना के माध्यम से सामाजिक–राजनीतिक बदलाव के वाहक के रूप में सामने आए हैं।

बलचनमा बड़ा होकर पटना के शहरी जीवन एवं संस्कृति को देखता–परखता है। गाँधीवादी स्वार्थी फूलबाबू से उसका मोहभंग होता है। कांग्रेसी फूलबाबू के साथ पटना आकर राजनीति का असली चेहरा उसके सामने आता है। "फूलबाबू के जेल चले जाने के बाद वह पटना में ही उनके एक मित्र परिवार के साथ रहता है, जहाँ उसके अनुभव, सोचने समझने की क्षमता और राजनीतिक चेतना में और भी प्रखरता आती है। फूलबाबू के जेल से लौटने पर उसे उन्हीं के साथ दरभंगा के कांग्रेस आश्रम में रहने का अवसर मिलता है जहाँ वह फूलबाबू तथा अन्य कांग्रेसी नेताओं के असली चेहरे देखता है। वह पाता है कि ये नेता अपने वर्गीय चरित्र को तनिक भी छोड़ नहीं पाए हैं। वह देखता है कि दैवी विपत्तियों से ग्रस्त किसानों की राहत के लिये जो सरकारी अनुदान मिलता है, उसे कांग्रेसी नेता अपने सम्बन्धियों में बाँट देते हैं और किसान ताकता रह जाता है।"[1]

वह कांग्रेसी नेताओं की संगत में तमाम दाँवपेंच भी सीख जाता है। 'बलचनमा' के माध्यम से न केवल नागार्जुन ने जमींदारों के अत्याचार और शोषण का चित्रण किया है बल्कि किसानों मजदूरों के प्रति संवेदनशील होकर अमानवीय स्थितियों का भी चित्रण किया है। नागार्जुन के उपन्यासों में जन जीवन से जुड़कर साहित्य ने सहजता पायी है। समाज के बहुसंख्यक जन को संकेतित करता उनका साहित्य जीवटता से परिपूर्ण है।

नागार्जुन के उपन्यासों की विशेषता है कि ये समूचे अंचल की समस्याओं को एक व्यक्ति के माध्यम से कह जाते हैं। एक ही व्यक्ति अपने समूचे वर्ग के प्रतिनिधि के तौर पर सामने आता है। उस एक व्यक्ति की कहानी में पूरे अंचल की कहानी समाहित होती है। 'बलचनमा' में नागार्जुन ने शोषितों का पक्ष मजबूत करते हुए लिखा है कि, "सच मानो भैया, उस बखत मेरे मन में यह बात बैठ गयी कि जैसे अंग्रेज बहादुर से सोराज लेने के लिए बाबू भैया लोग एक हो रहे हैं, हल्ला–गुल्ला और झगड़ा –झंझट मचा रहे हैं उसी तरह जन–बनिहार, कूली–मजूर और बहिया खबास लोगों को अपने हक के लिये बाबू भैया से लड़ना पड़ेगा।"[2] नागार्जुन का उपन्यास, नई पौध, सड़ी–गली परम्पराओं के खिलाफ नयी पीढ़ी को संघर्षरत दिखाता है। मिथिला के दरभंगा जिले के 'नवगछिया गाँव में लड़कियों का विक्रय किया जाता है। सौर मेले में ब्याह के लिये वर एकत्र होते हैं। वहाँ लोग जाकर लड़कियों के लिये वर खोजते हैं। उस समय समाज में बेमेल विवाह प्रचलित था। खोखा पण्डित विसेसरी की शादी पचपन वर्ष के दूल्हे से तय कर देते हैं विसेसरी और उसकी माँ दोनों ने ही इस विवाह का विरोध करने का निश्चय कर लिया था। उधर गाँव के नवजवानों को जब यह बात पता चलती है तो वे इसे नवगछिया गाँव की इज्जत का सवाल समझते हैं। आगे चलकर विससेरी का विवाह वाचस्पति नामक युवक से हो जाता है। वाचस्पति समाजवादी पार्टी का लीडर है और विसेसरी के उपयुक्त भी है। 'नई पौध' उपन्यास में नवयुवकों ने सड़ी–गली परम्परा का विरोध किया और समाज को नयी दिशा देने का काम किया। नागार्जुन ने इस उपन्यास के माध्यम से समाज के जड़बद्धता पर प्रहार किया है और नई चेतना को संकेतित किया है।

'वरुण के बेटे' उपन्यास [illegible] सामाजिक–आर्थिक–राजनीतिक पहलू को केन्द्र किया है इसमें मछुवारों के संघर्ष और जागरण को [illegible] किया गया है। नागार्जुन की दृष्टि यथार्थवादी है [illegible] आचार–विचार, संस्कृति को समेटते हुए [illegible] तथा अधिकारों के प्रति संघर्षरत दिखाते [illegible] नहीं राजनीतिक आंदोलनों में सक्रिय [illegible] 'गढ़पोखर का पट्टा अपने नाम [illegible] मछुवारों को इसमें मछली का शिकार [illegible] मछुवारों की समिति ने इस अन्याय [illegible] पहली बार किसी ने मछुवारों को केन्द्र [illegible] की थी। नागार्जुन ने आजादी के बाद [illegible] आर्थिक, राजनीतिक परिस्थितियों को केन्द्र [illegible] किया है।

नागार्जुन के अन्य [illegible] कुम्भीपाक, उग्रतारा, इमरतिया तथा [illegible] उपन्यासों में आंचलिकता सशक्त ढंग से रूपायित हुआ है। आंचलिकता के बहाने नागार्जुन लोकमानस को जोड़ा तथा संघर्ष का साक्षात्कार कराते हैं। नागार्जुन के पात्र ने ज्यादातर युवा शक्ति को जनचेतना के सशक्त स्वर तथा बदलाव के पक्षधर के

संघर्ष, सृजन एवं सांस्कृतिक बोध की वैचारिकी

जनवरी–मार्च 2016

परमिता

ISSN- 0974-6129

एक निर्णायक मण्डल युक्त शोध–पत्रिका

संपादकीय सम्पर्क

एन 1/61-आर 1, शशिनगर कालोनी

सामनेघाट रोड, नगवाँ लंका,

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सम्पादक व प्रकाशक डॉ. शशांक शुक्ला द्वारा एन 1/61-आर 1, शशिनगर कालोनी सामनेघाट रोड, नगवाँ, लंका, वाराणसी (उ.प्र.)-221005 से प्रकाशित तथा मेहरोत्रा ऑफसेट, इंग्लिशिया लाइन, वाराणसी से मुद्रित।

शोध

आंचलिकता और नागार्जुन

डॉ0 बृजेश कुमार पाण्डेय

नागार्जुन के उपन्यासों में आंचलिकता को लेकर कई बहसें हुई हैं। आंचलिक तत्वों की सघनता से ही कोई उपन्यास आंचलिक नहीं माना जा सकता। क्योंकि अनुभूति तथा संप्रेषण की अभिव्यक्ति के लिये कोई बिम्ब, पात्र, क्षेत्र तो हर लेखक को चुनना ही होता है। आंचलिकता एक स्वरूप है। जिस तरह नदी का अस्तित्व उसके बहाव पर निर्भर करता है उसी प्रकार आंचलिक उपन्यासों का अस्तित्व स्थानीय भाषा तथा वहां के धार्मिक–सामाजिक संस्कारों पर टिका होता है। आंचलिक उपन्यास में आदिम संस्कृति के तत्व होते हैं। आंचलिक उपन्यास का लक्ष्य किसी अंचल की देशीयता को व्याख्यायित करना है। अंचल एक विशिष्ट भूखण्ड होता है जो वाह्य प्रभावों से मुक्त रहता है। उसकी संस्कृति अपनी ही परिस्थितियों का परिणाम होती है। यह अपनी विशेषताओं के कारण अन्य क्षेत्रों से भिन्न दिखता है।

आंचलिक उपन्यास के रूप में बहुचर्चित 'मैला आंचल' रचनाकाल के दो वर्ष बाद प्रकाशित हुआ था। इस आधार पर नागार्जुन प्रथम आंचलिक उपन्यासकार माने जा सकते हैं। लेकिन रेणु के 'मैला आँचल' में आंचलिकता अपने सघन रूप में व्यक्त हुई है। आंचलिक उपन्यास के रूप में 'मैला आँचल' एक समग्रता समेटे हुए है। यह भी एक बड़ी वजह है, उसे हिन्दी का प्रथम आंचलिक उपन्यास मानने की। लेकिन नागार्जुन के उपन्यास प्रेमचन्द की ही परम्परा को आगे बढ़ाते दिखते हैं। नागार्जुन के उपन्यासों में मिथिला की मिट्टी की खूशबू है। मिथिला के जीवंत दृश्य उनके उपन्यासों का हिस्सा है। नागार्जुन के उपन्यासों में नायक अंचल नहीं है। उनके उपन्यासों में आम जिन्दगी के वे पात्र नायक हैं जो शायद प्रेमचंद की सजग दृष्टि से छूट गये थे।

नागार्जुन ने अपने अनुभवों तथा ज्ञान के स्तर पर जो हासिल किया, उसे विचारधारा के स्तर पर अभिव्यक्त करने की पूरी कोशिश की। कई बार उन्होंने दुनियां इस तरह देखा ही कि प्रत्यक्ष या अप्रत्यक्ष कोई भी समस्या हो उनके सामने आ जाए। आमतौर पर आजादी के बाद का ग्राम्य जीवन उनके उपन्यासों के केन्द्र में रहा। ग्राम्य जीवन के उभरते शोषण के नये समीकरणों पर उनकी दृष्टि बराबर नहीं रही। नागार्जुन ने युग की चेतना से प्रेरणा लेकर अपने पात्रों का चयन किया है। दरभंगा जिले के तरकुलवा गाँव के सामाजिक वातावरण को उन्होंने अपने उपन्यास में दर्शाया है। गाँव की आर्थिक स्थिति अच्छी नहीं है। यहाँ सभी जाति के लोग बसते हैं। इस उपन्यास में मिथिला के जीवन का हर पक्ष सामने आया है। इससे पता चलता है कि नागार्जुन का निजी अनुभव और निरीक्षण शक्ति कितनी गहरी है। उपन्यास का हर तथ्य इसका प्रमाण है। 'रतिनाथ की चाची' में निम्न मध्यवर्ग की समस्याएं आंचलिक वातावरण में उभारी गयी हैं। बेमेल विवाह, बाल विवाह जैसी समस्याएं यहाँ आम हैं।

गोपाल राय प्रेमचन्द की परम्परा से नागार्जुन को जोड़ते हुए लिखते हैं– 'नागार्जुन प्रेमचंद की परम्परा के उपन्यासकार हैं। प्रेमचंद ने उत्तर प्रदेश के अवध–बनारस क्षेत्र के किसानों की कथा के माध्यम से समस्त उत्तर भारत के किसानों की भाग्यगाथा प्रस्तुत की थी। नागार्जुन ने भी यही काम मिथिलांचल के गाँवों को अपनी कथा का मूल तत्व बनाकर किया। नागार्जुन के सामने मिथिला का सामाजिक रूढ़ियों में बुरी तरह जकड़ा हुआ समाज था, जहाँ विधवाओं को जीवित मृत होने की पीड़ा भुगतनी पड़ती थी, जहाँ आठ–दस वर्ष की बालिकाओं का विवाह साठ–पैंसठ वर्ष के बूढ़ों के साथ कर दिया जाता था, जहाँ कुलीनता के नाम पर एक व्यक्ति से दर्जनों कन्याएं ब्याह दी जाती थीं, जिसके चलते या तो विवाहित युवतियाँ घोर यातना का जीवन व्यतीत करती थीं अथवा व्याभिचार के लिये बाध्य होती थीं।'[1] ऐसे गंभीर पक्षों को नागार्जुन ने अपने उपन्यासों के माध्यम से प्रखरता से चित्रित किया। नागार्जुन उन किसानों को पात्र के रुप में चुनते हैं जो भूमिहीन हैं तथा बंधुआ मजदूर के रूप में अभिशप्त जिन्दगी जीने को बाध्य हैं।

नागार्जुन गाँवों में व्याप्त कुरीतियों के विरुद्ध अपने उपन्यासों में प्रखरता से विरोध दर्ज कराते हैं। वे लोक जीवन में कुरीतियों, अन्याय, सामंतवाद आदि बुराईयों पर गंभीर विमर्श करते हैं। आजादी के बाद गाँव जैसी छोटी इकाई में भी गहरे तक पैठ बना चुके शोषण को वे गम्भीरता से लेते हैं। जमींदारी उन्मूलन, कृषि का आधुनिकीकरण, पंचवर्षीय योजनाएं आदि के जटिल प्रश्न उनके उपन्यासों में पर्याप्त स्थान पाते हैं।

'रतिनाथ की चाची' में नारी जीवन की व्यथा चित्रित की गयी है। स्त्री को सिर्फ काम वासना की पूर्ति का साधन मानकर एक पुरुष–स्त्री को अपनी वासना का शिकार बनाता है। एक विधवा स्त्री के साथ बलपूर्वक अपनी यौनेच्छा की पूर्ति करना और फिर उसे अनचाहे गर्भ के साथ छोड़ देना, ऐसी कथा पाठक के हृदय को झकझोर देती है। रतिनाथ के प्रति उसकी चाची का असीम स्नेह है। इस स्नेह के कारण ही रतिनाथ का बाल विवाह रूक सका था। नागार्जुन ने समाज के एक ऐसे चेहरे के उघाड़ने का काम किया है जो स्त्री की चुप्पी के कारण ध्यान नहीं खींचता। नागार्जुन ने जिन मुद्दों को छुआ है वे आज भी कहीं न कहीं समाज को मथ रहे हैं। गाँवों में रहने वाली स्त्रियों की स्थिति शोचनीय रही है।

रतिनाथ की चाची के माध्यम से नागार्जुन ने विधवाओं की स्थिति का मार्मिक चित्रण किया है। गौरी और गौरी की माँ स्थितियों से समझौता करने के बजाए दृढ़ इच्छाशक्ति का सबूत देती हैं। नागार्जुन में उपेक्षितों के प्रति गहरी संवेदनात्मक समझ है। गौरी के गहरे जख्म नागार्जुन को उद्वेलित करते हैं। नागार्जुन जनवादी विचारों से प्रभावित हैं। इसलिये वे शोषितों के प्रति हो रहे अन्याय को अनदेखा करने के बजाए उनसे रचनात्मक टक्कर कर लेते हैं। वे रेणु की तरह अंचल को पात्र नहीं चुनते बल्कि अंचल से लिये गये पात्र की कहानी कहते हैं। रतिनाथ की चाची में गौरी सामाजिक विषमताओं, स्वार्थपरता के बीच पिस जाती है। नागार्जुन ने आंचलिक परिवेश में गौरी के माध्यम से नारी की व्यथा को चित्रित किया है।

नागार्जुन का दूसरा प्रसिद्ध उपन्यास 'बलचनमा' है, जो बिहार के दरभंगा जिला के ग्रामीण जीवन पर केन्द्रित है। यह उपन्यास एक निम्नवर्गीय किसान पुत्र के यातनापूर्ण जीवन की कथा है। पिता की मृत्यु के बाद से ही उसके जीवन में दुःख की

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International Journal of Current Research
Vol. 8, Issue, 12, pp.43536-43541, December, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

USE OF SILVER NANOPARTICLES SYNTHESIZED BIOLOGICALLY FROM MORINDA TINCTORIA LEAF EXTRACT FOR DEGRADATION OF METHYLENE BLUE DYE

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ARTICLE INFO

Article History:
Received 23rd September, 2016
Received in revised form
10th October, 2016
Accepted 29th November, 2016
Published online 30th December, 2016

Key words:

Silver Nanoparticles, Methylene Blue, Photocatalytic Degradation, Morinda tinctoria leaf extract, Green Synthesis, Spectroscopy.

ABSTRACT

Nowadays plant mediated synthesis of nanoparticles has great interest and achievement due to its eco-benign and low time consuming properties. In this study silver nanoparticles were successfully synthesized by using Morinda tinctoria leaf extract under different pH. The aqueous leaf extract was added to silver nitrate solution; the color of the reaction medium was changed from pale yellow to brown and that indicates reduction of silver ions to silver nanoparticles. Thus synthesized silver nanoparticles were characterized by UV-Vis spectrophotometer. Dispersity and morphology was characterized by scanning electron microscope (SEM); crystalline nature and purity of synthesized silver nanoparticles were revealed by X-ray diffraction (XRD) and energy dispersive X-ray spectroscopy (EDX). FTIR spectrum was examined to identify the effective functional molecules responsible for the reduction and stabilization of silver nanoparticles synthesized by leaf extract. The photocatalytic activity of the synthesized silver nanoparticles was examined by degradation of methylene blue under sunlight irradiation. Green synthesized silver nanoparticles were effectively degrading the dye nearly 95% at 72 h of exposure time.

Citation: Dr. Jayati Chatterjee Mitra and Dr. Neena Rai, 2016. "Use of Silver Nanoparticles Synthesized Biologically from Morinda tinctoria Leaf Extract for Degradation of Methylene Blue Dye", *International Journal of Current Research*, 8, (12), 43536-43541.

INTRODUCTION

Nanotechnology deals with the synthesis of nanoparticles with controlled size, shape, and dispersity of materials at the nanometer scale length (Li *et al.,* 2011) and their potential use for human well-being. Nanometer sized materials have a high surface area; and a high fraction of surface atoms (Jeevan *et al.,* 2012) have been studied because of their exclusive properties such as optic, electronic, and catalytic (Daniel and Astruc, 2004; Roduner, 2006; Guo *et al.,* 2008; Huang *et al.,* 2007; Peto *et al.,* 2002). Among all nanoparticles noble metal nanoparticles have enormous applications in diverse areas such as bioimaging, sensor, diagnosis, and novel therapeutic in biomedical field (Salata, 2004). Metallic silver and silver nanoparticles were recently applied as antimicrobial agents in various products such as cosmetics (Kokura *et al.,* 2010), animal feed (Højberg *et al.,* 2005), coating of catheters (Roe *et al.,* 2008), wound dressing (Fernández *et al.,* 2008), and water purification (Choi *et al.,* 2008) with a minimal risk of toxicity in humans. Nowadays the biological systems were eagerly used for nanoscale material synthesis and assembly is an alternative method of physical and chemical process. Green approach of nanoparticles synthesis by biological entities has been gaining great advantages which are environmental benign, less toxic, and time consuming; and also it is a single step process (Patil *et al.,* 2012). Currently, plant and plant derived materials are used for nanoparticles synthesis which is more compatible than the microbe-mediated nanoparticles synthesis process because they eliminate the culture maintenance and are easy to handle (Singaravelu *et al.,* 2007). Nanoparticles synthesis by medicinal plants shows more benefit; they may enhance the antibacterial activity of silver nanoparticles, because the medicinally valuable active biomolecule present in the plants may bind on the surface of the nanoparticles and reduce the silver ions to silver nanoparticles. Morinda tinctoria commonly known as Aal or Indian Mulberry is a species of flowering plant in the family Rubiaceae. The whole body of this plant has many medicinal properties. Leaves are used for curing ulceration, digestion, dyspepsia, diarrhea, stomatitis, wound, and fever. The leaf juice is used as a local application. The root is used to cure inflammation and boils (Mathivanan *et al.,* 2006; Kumaresan and Saravanan, 2009). The unripe fruit is used to cure rheumatism (Kanchanapoom *et al.,* 2002; Nadkarni, 1998; Wang *et al.,* 2002; Whistler, 1992). In this study, we successfully reported the biosynthesis of silver nanoparticles using M. tinctoria leaf extract. Synthesized silver nanoparticles were applied to dye degradation under sunlight irradiation.

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MATERIALS AND METHODS

Preparation of Green Reducing Agent

Leaves of Morinda tinctoria were collected from the Ranisagar, Kota Area of Dr. C.V.Raman University campus, Bilaspur, India. 10 g wet weight of fresh leaves was cut into fine pieces and washed with distilled water and boiled with 100 mL of double distilled water for 10 min at 60°C. Boiled mixture was filtered through Whatman filter paper No. 1 and collected the supernatant of leaf extract, then stored at 4°C for further nanoparticles synthesis process.

Phytosynthesis of Silver Nanoparticles

Aqueous solution of silver nitrate was prepared using double distilled water at a concentration of 1 mM. Silver nitrate was purchased from HiMedia, Mumbai. 10 mL of freshly prepared leaf extract was added to 90 mL of aqueous solution of silver nitrate and kept at room temperature for the reduction of silver ions to silver nanoparticles. Nanoparticles formation was visually identified by color change and followed the UV-Vis spectrum analysis. The pH of leaf extract was altered to study its effects on synthesis of silver nanoparticle. The various pH (4.6, 5.6, 6.6, 7.6, and 8.6) of the 10 mL of leaf extract were added into 90 mL of 1 mM silver nitrate solution. The pH was adjusted by using 0.1 N NaOH and 0.1 N HCl. Formation of silver nanoparticles was measured by UV-Vis spectrophotometer at different wavelengths.

Characterization of Phytosynthesized Silver Nanoparticles

The reduction of silver ions was monitored by measuring double beam UV-Vis spectra of the reaction medium at different wavelengths from 360 to 700 nm at different functional time (PerkinElmer, Singapore). The silver nano-particle solution thus obtained was purified by repeated centrifugation at 7000 rpm for 15 min and dried at 100°C. Crystalline nature of the nanoparticles was analyzed by XRD at 2θ ranges from 20 to 80°C (Philips PW 1830). The morphology and size of the silver nanoparticles were found by Scanning Electron Microscope (Philips CM-200). Elemental analysis of silver was carried out by EDX (Philips XL-30). Functional biomolecules associated with silver nanoparticles were confirmed by FTIR, which is involved in the reduction of silver ions into silver nanoparticles. The FTIR spectrum was obtained on a Shimadzu instrument with the sample as KBr pellet in the wavenumber region of 500–4,000 cm^{-1}.

Photocatalytic Degradation of Dye

Typically 10 mg of methylene blue dye was added to 1000 mL of double distilled water used as stock solution. About 10 mg of biosynthesized silver nanoparticles was added to 100 mL of methylene blue dye solution. A control was also maintained without addition of silver nanoparticles. Before exposing to irradiation, the reaction suspension was well mixed by being magnetically stirred for 30 min to clearly make the equilibrium of the working solution. Afterwards, the dispersion was put under the sunlight and monitored from morning to evening sunset. At specific time intervals, aliquots of 2-3 mL suspension were filtered and used to evaluate the photocatalytic degradation of dye. The absorbance spectrum of the supernatant was subsequently measured using UV-Vis spectrophotometer at the different wavelength. Concentration of dye during degradation was calculated by the absorbance value at 660 nm. Percentage of dye degradation was estimated by the suitable formula where remains the initial concentration of dye solution and is the concentration of dye solution after photocatalytic degradation.

RESULTS AND DISCUSSION

Optical Observation

Initially, while adding the leaf extract of Morinda tinctoria to the silver ion solution, the color of the solution was turned into yellowish brown which indicates the formation of silver nanoparticles (Sastry *et al.,* 1998) (Figure 1). The formation of color occurred due to the excitation of surface Plasmon resonance of the silver nanoparticles (Mulvaney, 1996). The result obtained in this investigation is very interesting in terms of identification of potential plants for synthesizing the silver nanoparticles (Prasad and Elumalai, 2004). Similarly, Govindaraju *et al.* (2010) observed the color change to brownish yellow while synthesizing silver nanoparticles using the leaf extract of Solanum torvum. Rao and Savithramma (Rao and Savithramma, 2011) also reported that the Svensonia hyderabadensis solution of the silver ion complex started to change the color from yellow to dark brown due to the reduction of silver ions.

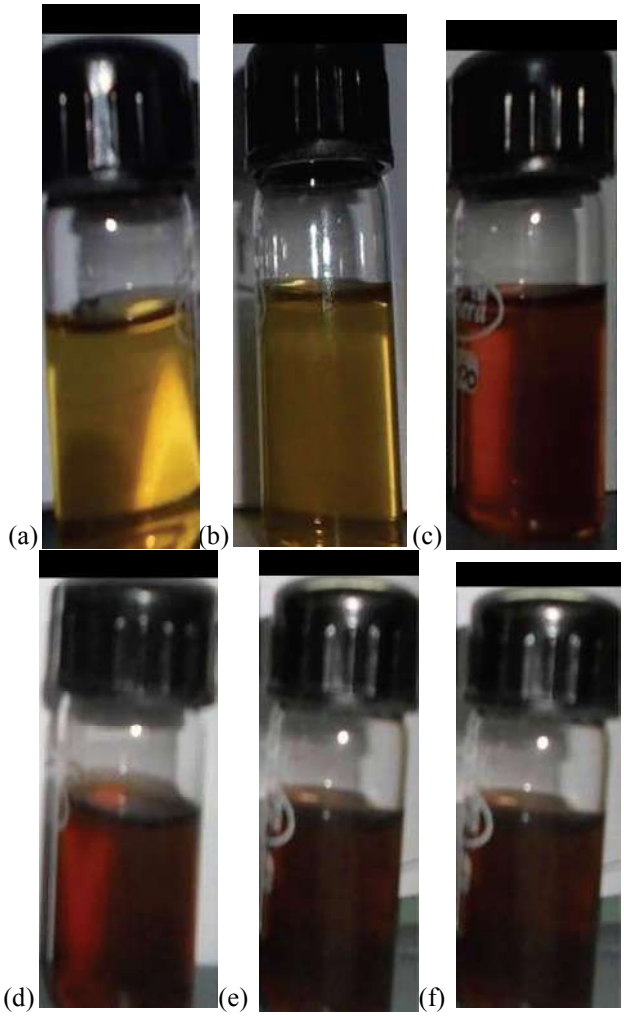

Figure 1. Visual identification of silver nanoparticles synthesized by *M. tinctoria* leaf extract at pH 8.6 as recorded at different functional time (a) initial, (b) 10 min, (c) 30 min, (d) 1 h, (e) 2 h, and (f) 4 h). The formation of dark brown colour revealed the formation of silver nanoparticles in the reaction mixture

Chen *et al.* (2004) reported the intensity of the color development in the reaction mixture of different plants such as in Helianthus annuus, Basella alba, and Saccharum officinarum. Role of pH in the synthesis and nature of silver nanoparticles was investigated by changing the experiment pH which was characterized by color change of reaction mixture and UV-Vis spectrophotometer. pH plays an important role in the synthesis and controlling size and shape of nanoparticles. The colour and the intensity peaks of nanoparticles were pH dependent. At pH 4.6, no color change occurred. It indicates acidic pH suppresses the nanoparticles synthesis. At pH 5.6, the yellow colour was formed at 10 min incubation and turned into brown colour at 30 min which indicates formation of silver nanoparticles. It was similarly observed in the following pH 6.6. At 1 h time of incubation both show dark blackish brown color with precipitation which indicates completion of nanoparticles synthesis. At high pH 7.6 and 8.6, the brown colour was maintained for several weeks without precipitation which indicates stabilized synthesized nanoparticles (Figure 1). Under the acidic conditions such biomolecules are likely to be inactivated so that the nanoparticles synthesis could not occur at pH 4.6. The differences in the arising of color over the various pH could be due to the presence of various dissociated functional groups on the leaf extract that are actively involved in the synthesis process (Bankar *et al.,* 2010). At higher pH, however, more number of small sized nanoparticles was synthesized due to the availability of large number of functional groups for silver binding (Sathishkumar *et al.,* 2009). Sathishkumar et al. 2009 reported that higher pH influences the formation of more of spherical shape rather than ellipsoidal silver nanoparticles was synthesized by using Cinnamon zeylanicum bark extract. Interestingly, even high pH 8.6 was also found to be efficient in producing nanoparticles, but they agglomerated within few days.

UV-Vis Spectrophotometric Analysis

pH plays an important role in the nanoparticles synthesis; this factor induces the reactivity of leaf extract with silver ions. Figure 2 shows the effect of pH on the nanoparticles synthesis. Acidic pH 4.6 and 5.6 show the peak between 320 and 350 nm initially, and then these were maintained till 1 h of incubation time. After 1 hr, another band appeared at 450 nm with broadened nature indicating the formation of larger sized nanoparticles. After 24 h, the peak was changed into 470 nm with high agglomeration due to the lack of stabilizing agent. At pH 6.6 initially the peak occurred at 340 nm, and the second band was formed at 420–430 nm indicating the synthesis of silver nanoparticles. After 24 h, the peak positions were changed into 360 and 470 nm due to the aggregation of nanoparticles. The lower absorbance was observed in the acidic pH due to suppression of nanoparticles synthesis. In the alkaline pH 7.6 and 8.6, nanoparticles synthesis was high by observing the absorbance. In the alkaline pH, the SPR band was positioned at 380 nm and 420 nm by forming the narrow peak indicating particles are in small size. High stabilized nanoparticle was synthesized at the alkaline pH. With increasing the pH of the reaction the optical absorbance was increased and also small sized nanoparticles were synthesized very quickly.

In the low pH the nanoparticles were agglomerated and formed large sized nanoparticles (Mock *et al.,* 2002). Size, shape and distribution of nanoparticles were depending on the formation of one or more surface Plasmon resonance (SPR) bands. Formation of a single SPR band at short wavelengths revealed the presence of small sized spherical nanoparticles in the reaction mixture, whereas two or more SPR bands were shown at larger wavelengths indicates presence of large anisotropic nanoparticles (Kumar *et al.,* 2012). Therefore, the narrow peak at 420 nm is likely shown due to formation of small spherical silver nanoparticles. Similarly the two bands for silver nanoparticles were early reported by Kumar *et al.* 2012 Silver nanoparticles were highly synthesized with small size in the alkaline pH due to the availability of large amount of positive functional groups in the leaf extract that allows silver ions to get more binding sites (Mohanpuria *et al.,* 2008). Similarly, Dwivedi and Gopal, 2010 reported synthesized nanoparticles are stable under a wide pH range and also they elaborated that lower pH 2 shows lower and broader absorbance as compared to the pH 4 onwards which can be due to the formation of larger nanoparticles.

Scanning Electron Microscope

SEM image shows the size and shape of the biosynthesized silver nanoparticles using M. tinctoria leaf extract. Size of the nanoparticles was observed at different magnifications. Spherical and rod shape of nanoparticles with high agglomeration was noted with the size range from 79 to 96 nm. In this SEM image, some of the nanoparticles show large size due to the aggregation of small size of nanoparticles (Figure 2). Polydispersed nanoparticles were observed in SEM image and revealed the result of UV-Vis spectrophotometer. The surfaces of aggregated nanoparticles were shown to be rough. Similarly, aggregation of nanoparticles was earlier reported by Ramgopal *et al.* 2011 by using the extract of soap nuts in the reduction of silver ions. Aggregation of nanoparticles took place due to the insufficiency of capping agent in the leaf extract to synthesis of nanoparticles.

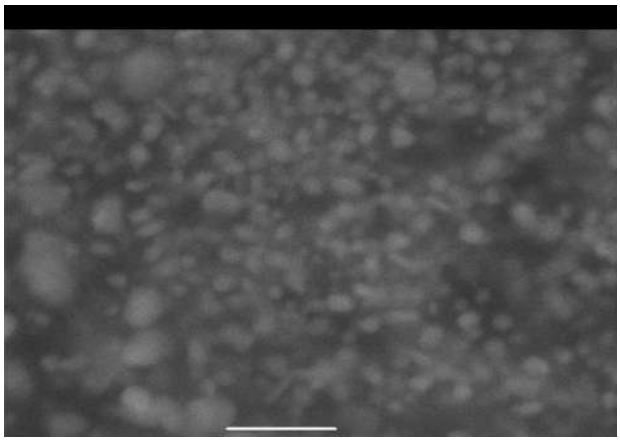

Figure 2. SEM images of silver nanoparticles synthesized from *M.tinctoria* leaf extract show highly agglomerated spherical shape

XRD and EDX

Crystalline size and structure of the silver nanoparticles were carried out by XRD. The biosynthesized silver nanostructure by employing M. tinctoria leaf extract was further demonstrated and confirmed by the characteristic peaks observed in the XRD image (Figure 3). The four distinct diffraction peaks of the 2θ values of 38.26°C, 44.44°C, 64.58°C and 77.67°C can be assigned to the planes of , , , and , respectively, which indicates the silver nanoparticles are fcc and crystalline in nature (JCPDS file nos. 84-0713 and 04-

0783). The broadening of Bragg's peaks indicates the formation of nanoparticles.

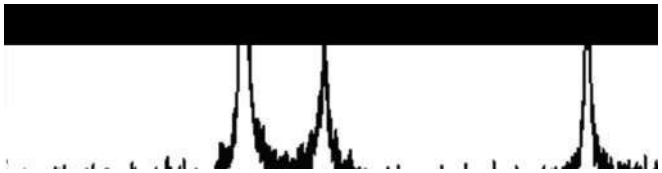

Figure 3. XRD spectrum of green synthesized silver nanoparticles

Elemental analysis of silver was measured by EDX; EDX spectra reveal strong signals in the silver region of 3 keV and confirm the formation of nanosilver and its elemental nature. This signal was formed due to the excitation of surface Plasmon resonance of silver nanoparticles. Some of the weak signals from Cl were observed. These signals were found due to maybe the presence of impurity from the biological molecules of leaf extract (Figure 4).

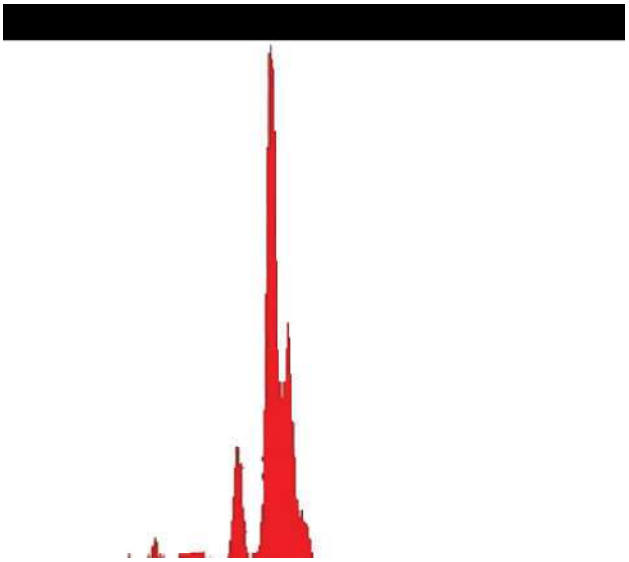

Figure 4. EDX spectrum of synthesized silver nanoparticles by *M.tinctoria* leaf extract

FTIR

FTIR measurements were carried out to identify the potential functional groups of the biomolecules in the leaf extract of M. tinctoria which are responsible for the reduction of the silver ions into silver nanoparticles. Figure 5 shows a strong absorption peak at 3296 cm^{-1} which indicates presence of carboxylic groups. This functional group was modified in synthesized silver nanoparticles. The broad absorption band was observed between 3436 and 3220 cm^{-1} due to the O–H stretching and H- bonded alcohols and phenol groups (Figure 6). A weak band was observed at 1634 cm^{-1} corresponding to N–H bending primary amines. It was modified into 1672 cm^{-1} indicating presence of C=O stretching vibrations of carbonyls groups, respectively. New narrow bands were formed in the synthesized silver nanoparticles at 1384 cm^{-1} and 1134 cm^{-1} owing to the $–NO_2$ aliphatic nitro groups and C–N stretching of aliphatic amines and C–O stretching of carboxylic groups. The two weak bands at 823 cm^{-1} and 724 cm^{-1} disappeared in the synthesized silver nanoparticles. A small peak was formed at 604 cm^{-1} due to the occurrence of alkyl halides (Figure 6). Moreover, the functional biomolecules are hydroxyl, carboxylic, phenol, and amine groups in M. tinctoria leaf extract involved in the reduction of silver ions which was confirmed by FTIR spectrum. Nagati *et al*. 2012 reported that the aliphatic amine, aliphatic alkenes of alkaloids, and terpenoids bound on the surface of Cajanus cajan leaf extract mediated synthesized AgNPs.

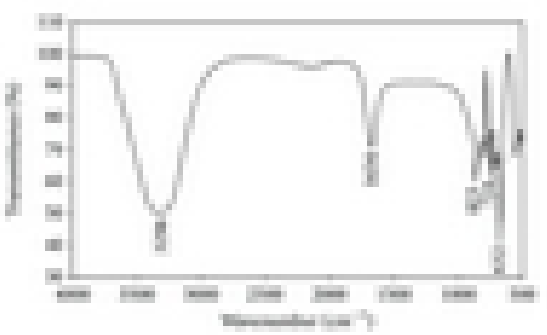

Figure 5. FTIR spectrum of aqueous leaf extract of M. tinctoria

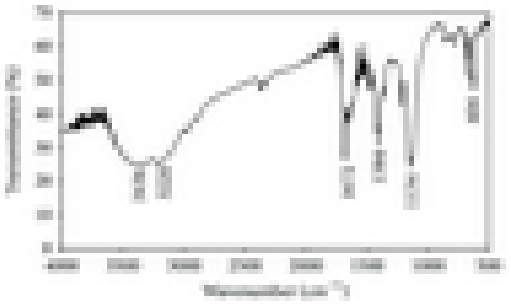

Figure 6. FTIR spectrum of green synthesized silver nanoparticles using M. tinctoria leaf extract

Photocatalytic Degradation of Dye

Visual Observation

Photocatalytic degradation of methylene blue was carried out by using green synthesized silver nanoparticles under solar light. Dye degradation was initially identified by color change. Initially, the color of dye shows deep blue color changed into light blue after the 1 h of incubation with silver nanoparticles while exposed to solar light. Thereafter light blue was changed into light green.

(a) (b) (c) (d) (e) (f) (g) Control

Figure 7. Visual observation of color change from blue to colorless indicates degradation of methylene blue dye at different time intervals (a) initial, (b) 1 h, (c) 4 h, (d) 24 h, (e) 48 h, and (f) 72 h)

Finally, the degradation process was completed at 72 h and was identified by the change of reaction mixture color to colorless.

UV-Vis Spectrophotometer

Photocatalytic activity of silver nanoparticles on degradation of dye was demonstrated by using the dye methylene blue. The degradation of methylene blue was carried out in the presence of silver nanoparticles at different time in the visible region. The absorption spectrum showed the decreased peaks for methylene blue at different time intervals. Initially, the absorption peaks at 660 nm for methylene blue dye were decreased gradually with the increase of the exposure time and that indicates the photocatalytic degradation reaction of methylene blue. The absorption peak of methylene blue dye was decreased, and absorption band for silver nanoparticles was increased at 420 nm. The completion of the photocatalytic degradation of the dyes is known from the gradual decrease of the absorbance value of dye approaching the base line and increased peak for silver nanoparticles. While decreasing the concentration of dye, UV spectra show typical SPR band for silver nanoparticles at 22 h of exposure time. The percentage of degradation efficiency of silver nanoparticles was calculated as 95.3% at 72 h. The degradation percentage was increased as increasing the exposure time of dye silver nanoparticles complex in sunlight. Absorption peak for methylene blue dye was cantered at 660 nm in visible region which diminished and finally it disappeared while increasing the reaction time, which indicates that the dye had been degraded.

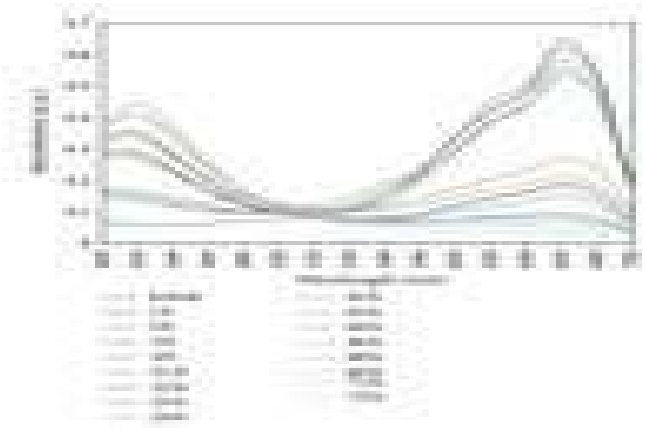

Figure 8. The absorption spectra of aqueous solution of methylene blue treated with 10 mg of synthesized silver nanoparticles using M. tinctoria at different time intervals

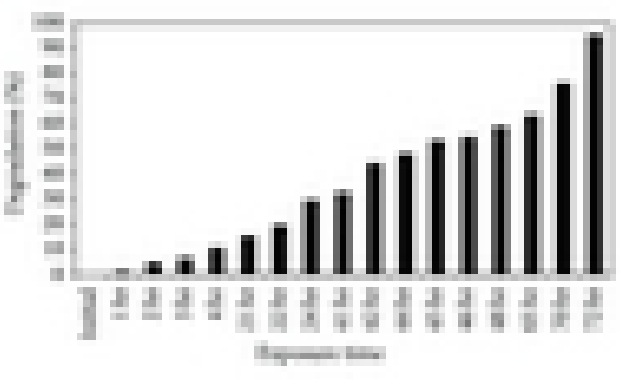

Figure 9. Percentage of dye degradation by 10 mg of synthesized silver nanoparticles at different functional time intervals

Conclusion

Green nanotechnology is gaining importance due to the elimination of harmful reagents and provides effective synthesis of expected products in an economical manner. Green synthesis of silver nanoparticles shows more compatible, ecofriendly, low cost, and less time consuming process. Herein, the silver nanoparticles were synthesized by using plant leaf extract of M. tinctoria under different pH. Silver nanoparticles formation was not detected in the acidic medium. In the alkaline medium, the size as well as the quantity of the silver nanoparticles formed is strongly dependent on the pH characterized by UV-Vis spectrophotometer. Spherical shape of the nanoparticles with the size ranges from 79 to 96 nm was confirmed by SEM. Crystalline nature was characterized by XRD, and presence of elemental silver was analyzed by EDX spectrum. The photocatalytic activity of green synthesized silver nanoparticles was evaluated by choosing methylene blue dye. The main absorption peak at 660 nm decreased gradually with the extension of the exposure time indicating the photocatalytic degradation of methylene blue dye. The present study, it is found that the use of natural renewable and eco-friendly reducing agent used for synthesis of silver nanoparticles exhibits excellent photocatalytic activity against dye molecules and can be used in water purification systems and dye effluent treatment.

REFERENCES

Bankar, A., B. Joshi, A. R. Kumar, and S. Zinjarde, 2010. "Banana peel extract mediated novel route for the synthesis of silver nanoparticles," *Colloids and Surfaces A*, vol. 368, no. 1–3, pp. 58–63.

Chen, S., S. Webster, R. Czerw, J. Xu, and D. L. Carroll, 2004. "Morphology effects on the optical properties of silver nanoparticles," *Journal of Nanoscience and Nanotechnology*, vol. 4, no. 3, pp. 254–259.

Choi, O., K. K. Deng, N.-J. Kim, L. Ross Jr., R. Y. Surampalli, and Z. Hu, 2008. "The inhibitory effects of silver nanoparticles, silver ions, and silver chloride colloids on microbial growth," *Water Research*, vol. 42, no. 12, pp. 3066–3074.

Daniel, M.C. and D. Astruc, 2004. "Gold nanoparticles: assembly, supramolecular chemistry, quantum-size-related properties, and applications toward biology, catalysis, and nanotechnology," *Chemical Reviews*, vol. 104, no. 1, pp. 293–346.

Dwivedi, A. D. and K. Gopal, 2010. "Biosynthesis of silver and gold nanoparticles using Chenopodium albumleaf extract," *Colloids and Surfaces A,* vol. 369, no. 1–3, pp. 27–33.

Fernández, E. J., J. García-Barrasa, A. Laguna, J. M. López-De-Luzuriaga, M. Monge, and C. Torres, 2008. "The preparation of highly active antimicrobial silver nanoparticles by an organometallic approach," *Nanotechnology*, vol. 19, no. 18, Article ID 185602.

Govindaraju, K., S. Tamilselvan, V. Kiruthiga, and G. Singaravelu, "Biogenic silver nanoparticles by Solanum torvum and their promising antimicrobial activity*," Journal of Biopesticides*, vol. 3, no. 1, pp. 394–399.

Guo, J.Z., H. Cui, W. Zhou, and W. Wang, 2008. "Ag nanoparticle-catalyzed chemiluminescent reaction between luminol and hydrogen peroxide*," Journal of*

Photochemistry and Photobiology A, vol. 193, no. 2-3, pp. 89–96.

Højberg, O., N. Canibe, H. D. Poulsen, M. S. Hedemann, and B. B. Jensen, 2005. "Influence of dietary zinc oxide and copper sulfate on the gastrointestinal ecosystem in newly weaned piglets," *Applied and Environmental Microbiology*, vol. 71, no. 5, pp. 2267–2277.

Huang, C. C., Z. Yang, K. H. Lee, and H. T. Chang, 2007. "Synthesis of highly fluorescent gold nanoparticles for sensing mercury(II)," *Angewandte Chemie International Edition*, vol. 46, no. 36, pp. 6824–6828.

Jeevan, P., K. Ramya, and A. E. Rena, 2012. "Extracellular biosynthesis of silver nanoparticles by culture supernatant of Pseudomonas aeruginosa," Indian *Journal of Biotechnology*, vol. 11, no. 1, pp. 72–76.

Kanchanapoom, T., R. Kasai, and K. Yamasaki, 2002. "Iridoid and phenolic glycosides from Morinda coreia," *Phytochemistry*, vol. 59, no. 5, pp. 551–556. A. K.

Kokura, S., O. Handa, T. Takagi, T. Ishikawa, Y. Naito, and T. Yoshikawa, 2010. "Silver nanoparticles as a safe preservative for use in cosmetics," *Nanomedicine*, vol. 6, no. 4, pp. 570–574.

Kumar, R., S. M. Roopan, A. Prabhakarn, V. G. Khanna, and S. Chakroborty, 2012. "Agricultural waste Annona squamosa peel extract: biosynthesis of silver nanoparticles," *Spectrochimica Acta A*, vol. 90, pp. 173–176.

Kumaresan, P. T. and A. Saravanan, 2009. "Anticonvulsant activity of Morinda tinctoria-Roxb*," African Journal of Pharmacy and Pharmacology*, vol. 3, no. 2, pp. 63–65.

Li, X., H. Xu, Z. Chen, and G. Chen, 2011. "Biosynthesis of nanoparticles by microorganisms and their applications," *Journal of Nanomaterials*, vol. Article ID 270974, 16 pages, 2011.

Mathivanan, N., G. Surendiran, K. Srinivasan, and K. Malarvizhi, 2006. "Morinda pubescens J.E. Smith (Morinda tinctoria Roxb.) fruit extract accelerates wound healing in rats," Journal of Medicinal Food, vol. 9, no. 4, pp. 591–593.

Mock, J. J., M. Barbic, D. R. Smith, D. A. Schultz, and S. Schultz, 2002. "Shape effects in plasmon resonance of individual colloidal silver nanoparticles," *Journal of Chemical Physics,* vol. 116, no. 15, pp. 6755–6758.

Mohanpuria, P., N. K. Rana, and S. K. Yadav, 2008. "Biosynthesis of nanoparticles: technological concepts and future applications," *Journal of Nanoparticle Research*, vol. 10, no. 3, pp. 507–517.

Mulvaney, P. 1996. "Surface plasmon spectroscopy of nanosized metal particles," *Langmuir*, vol. 12, no. 3, pp. 788–800.

Nadkarni, 1998. "Morinda tinctoria leaf is used as astringent, deobstrent, emmengogue and to relieve pain in the gout Indian Matria Medica," Popular Prakashan, Mumbai, India.

Nagati, V., R. Koyyati, M. R. Donda, J. Alwala, K. R. Kundle, and P. R. M. Padigya, 2012. "Green synthesis and characterization of silver nanoparticles from Cajanus cajan leaf extract and its antibacterial activity," *International Journal of Nanomaterials and Biostructures*, vol. 2, no. 3, pp. 39–43.

Patil, R. S., M. R. Kokate, and S. S. Kolekar, 2012. "Bioinspired synthesis of highly stabilized silver nanoparticles using Ocimum tenuiflorum leaf extract and their antibacterial activity," *Spectrochimica Acta A,* vol. 91, pp. 234–238.

Peto, G., G. L. Molnar, Z. Paszti, O. Geszti, A. Beck, and L. Guczi, 2002. "Electronic structure of gold nanoparticles deposited on Si_{Ox}/Si(100)," *Materials Science and Engineering C*, vol. 19, no. 1-2, pp. 95–99.

Prasad, T. N. V. K. V. and E. K. Elumalai, 2011. "Biofabrication of Ag nanoparticles using Moringa oleifera leaf extract and their antimicrobial activity," *Asian Pacific Journal of Tropical Biomedicine*, vol. 1, no. 6, pp. 439–442.

Ramgopal, M., C. H. Saisushma, I. H. Attitalla, and A. M. Alhasin, 2011. "A facile green synthesis of silver nanoparticles using soap nuts," *Research Journal of Microbiology,* vol. 6, no. 5, pp. 432–438.

Rao, M. L. and N. Savithramma, 2011. "Biological synthesis of silver nanoparticles using Svensonia Hyderabadensis leaf extract and evaluation of their antimicrobial efficacy," *Journal of Pharmaceutical Sciences and Research,* vol. 3, no. 3, pp. 1117–1121.

Roduner, E. 2006. "Size matters: why nanomaterials are different," Chemical Society Reviews, vol. 35, no. 7, pp. 583–592.

Roe, D., B. Karandikar, N. Bonn-Savage, B. Gibbins, and J. B. Roullet, 2008. "Antimicrobial surface functionalization of plastic catheters by silver nanoparticles," *Journal of Antimicrobial Chemotherapy,* vol. 61, no. 4, pp. 869–876.

Salata, O. V. 2004. "Applications of nanoparticles in biology and medicine," *Journal of Nanobiotechnology*, vol. 2, article 3.

Sastry, M., V. Patil, and S. R. Sainkar, 1998. "Electrostatically controlled diffusion of carboxylic acid derivatized silver colloidal particles in thermally evaporated fatty amine films," *Journal of Physical Chemistry B*, vol. 102, no. 8, pp. 1404–1410.

Sathishkumar, M., K. Sneha, S. W. Won, C. W. Cho, S. Kim, and Y. S. Yun, 2009. "Cinnamon zeylanicum bark extract and powder mediated green synthesis of nano-crystalline silver particles and its bactericidal activity," *Colloids and Surfaces B,* vol. 73, no. 2, pp. 332–338.

Singaravelu, G., J. S. Arockiamary, V. G. Kumar, and K. Govindaraju, 2007. "A novel extracellular synthesis of monodisperse gold nanoparticles using marine alga, Sargassum wightii Greville," Colloids and Surfaces B, vol. 57, no. 1, pp. 97–101.

Wang, M. Y., B. J. West, C. J. Jensen et al., 2002. "Morinda citrifolia (Noni): a literature review and recent advances in Noni research," *Acta Pharmacologica Sinica*, vol. 23, no. 12, pp. 1127–1141.

Whistler, W. A. 1992. Tongan Herbal Medicine, University of Hawaii Press, Honolulu, Hawaii, USA.

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ISSN (ONLINE): 2394-8442

FATE OF ANTIBIOTICS IN THE ENVIRONMENT: AN ANALYTICAL STUDY

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ABSTRACT.

It is known that antibiotics are the new contaminants of concern in the aquatic environment as they pass through the body largely unmetabolized & directly enter into the water-systems. The purpose of this study is to determine the overall transformation potential of some antibiotic drugs in wastewaters with specific emphasis on their analytical study. Due to wide application of antibiotics, it is impossible to entirely hamper their penetration into water bodies, so it is necessary to limit their content in water. The study selected six antibiotics namely Erythromycin (ERY), Sulfamethoxazole(SFX), Amoxicillin(AMX), Cefadroxil(CFX), Ciprofloxacin(CIP) and Oxytetracycline(OTC) due to their rapid and widespread use. So, a rapid, quick, simple, easy and reliable method has been developed for the analytical determination of the antibiotics. Ion-association complex is formed between the drug and the reagent with simultaneous use of Phosphomolybdic-acid (PMA) as the colorimetric reagent. The colored complex so formed can be easily extracted in the organic solvents. The molar absorptive value of the complex was detected which lies in many varying ranges of $Lmol^{-1}cm^{-1}$. The method of determination in the initial step is based on the hydrolysis of the ring of analytes (antibiotics) on heating with sodium hydroxide in presence of catalyst and the reaction of hydrolyzed products with potassium iodate in acidic medium. The liberated iodine further oxidizes the reagent to a colored chromophore species. This involves accurate process for the determination of all the antibiotic drugs as the n-donors with 3-acceptors, which yielded colored radical anions.

Key Words: Antibiotics, Unmetabolized, PMA, Colorimetric Reagent, water system,

1. Introduction

Recent Studies have determined that a variety of antibiotics are present in surface and groundwater bodies throughout India, as well as in many other countries across the world [Halling-Sorensen et.al.,(1998), Kolpin et.al.,(1999)]. This occurs in part from the discharge or disposal of antibiotics from medical, municipal and agricultural sources [Daughton and Ternes (1999)]. A portion of the administered antibiotics are excreted un-metabolized by patients and can be found in hospital effluents and municipal sewage. Most antibiotics are metabolized incompletely after administration and enter the aquatic system, municipal sewage with their excretions. Some of the municipal sewage systems send these antibiotics (pharmaceutical drugs) freely into the planet's ecosystem. Some antibiotics are carcinogenic, mutagenic, teratogenic and fetotoxic. Little is known about their environmental impact and also little is known about their biodegradability in the aquatic environments and their role with respect to growing bacterial resistance.

Therefore, the biodegradability of some clinically important antibiotic drugs as a very first step of an environmental risk assessment is to be investigated. So, recently, the occurrence and fate of antibiotics in the aquatic environment was recognized as one of the emerging issues in environmental chemistry and as a matter of public concern.With increase in the intensive use of antibiotics in agriculture and direct land application of waste, there is a concern that excreted compounds will migrate to the receiving environment with potential impact on surface and groundwater. Research has begun to determine the concentrations of antibiotics in the environment, and from this information the health effects to humans and animals may be estimated by toxicologists.

An additional problem that may be created by the presence of antibiotics at low concentrations in the environment is the development of antibiotic resistant bacteria. In recent years, the incident of antibiotic resistant bacteria has increased and many people believe that the increase is due to excessive use of antibiotics [Walter et al.,(1985)]. The presence of antibiotic can result in selective pressure that favors organisms that possess genes coding for antibiotic resistance. This may pose a serious threat to public health in that more and more infections can no longer be treatable with known antibiotics [Hirsch et. al., (1999)].

To Cite This Article: Dr. JAYATI CHATTERJEE MITRA, Dr. NEENA RAI AND Dr. SANTOSH K. SAR,.FATE OF ANTIBIOTICS IN THE ENVIRONMENT: AN ANALYTICAL STUDY. **Journal for Advanced Research in Applied Sciences ; Pages: 64-77**

In the event that antibiotic resistance is spread from nonpathogenic to pathogenic bacteria, epidemics may result. Antibiotics are introduced in longer amount and they are proactive, polar & persistent which may cause adverse effects in aquatic life & humans. So, it is important to give economical and technical solutions for treatment of antibiotics wastewater which contains non-biodegradable organics. For these reasons, the search for solutions of this problem is an interesting research topic. **Antibiotic: The Analyte**: If we look at the human history, we can realize that our ability to control infectious diseases is a recent development. The strongest advance in chemotherapy has been the discovery and industrial production of antibiotics, chemical substances, isolated from living organisms as molds and actinomycetes, which are able to inhibit the life processes of microorganisms.

Nevertheless, the introduction of the antimicrobial agent into the microbial surroundings represents a change in the cell environments. If all microorganisms are sensitive to the change then the whole population will be eliminated. But if few members in the population, which were resistant to the effects of the antibiotic, could survive and could reproduce a new population will grow up. This new population has a different DNA than the original Population because they have mutated and this allows the microorganisms to resist the effect of the antibiotic. Antimicrobial resistance is an inevitable natural biological phenomenon that is exacerbated by the abuse, overuse and misuse of antibiotics in the treatment of human illness and in animal husbandry, aquaculture and agriculture.

Disease as well as resistance also thrives in conditions of civil unrest, poverty, mass migration and environmental degradation where large numbers of people are exposed to infectious diseases with little in the way of the most basic health care. Drug resistance is the most telling sign that we have failed to take the threat of infectious diseases seriously. It suggests that we have mishandled our precious arsenal of disease fighting drugs, both by overusing them in developed nation and, paradoxically both misusing and under using them in developing nations (WHO, 2000). The use of antibiotics generates wastes with considerable amount of unaltered antibiotic, since the biological absorption of these antimicrobial agents under the metabolic pathways in humans and animals is around 30%, 70% of an administered doze is excreted unchanged, by the living organism and disposed into the waste water system.

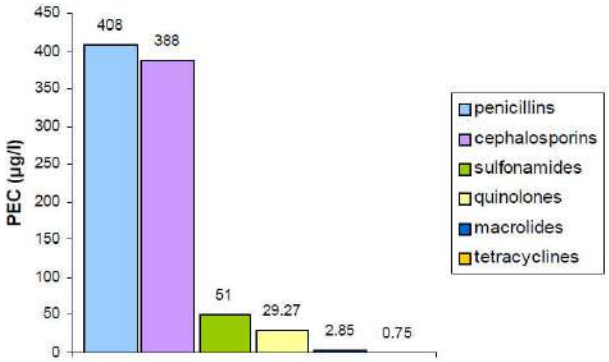


Fig. 1.0 Predicted environment concentrations of antibiotics in hospital effluents

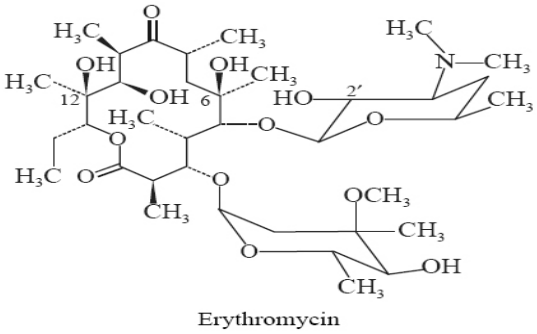


Fig. 1.1 Structure of Erythromycin (ERY)

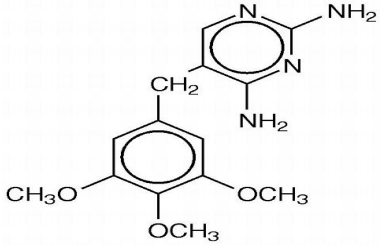


Fig. 1.2 Structure of Sulfamethoxazole (SFX)

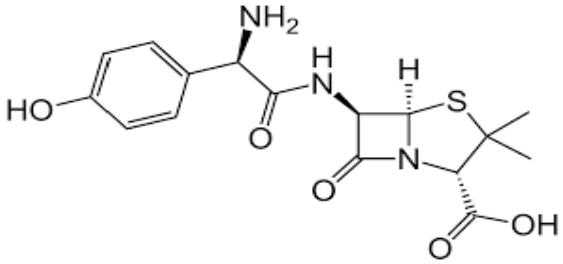


Fig. 1.3 Structure of Amoxicillin (AMX)

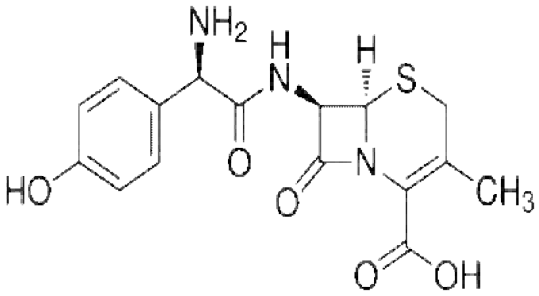


Fig. 1.4 Structure of Cefadroxil (CFX)

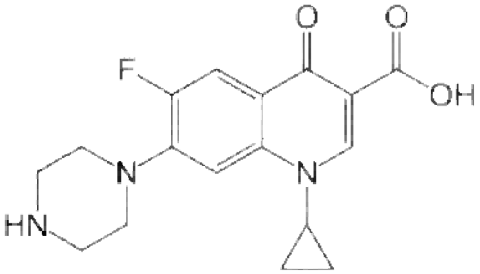


Fig. 1.5 Structure of Ciprofloxacin (CIP)

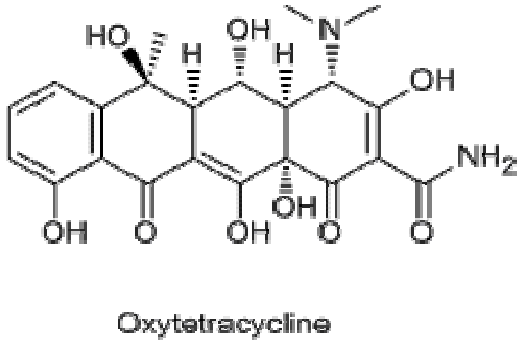


Fig. 1.6 Structure of Oxytetracycline (OTC)

2. Materials and Methodology

The sampling sites of various water systems for sample collection:

The sampling sites selected for the sample collection were categorized under two types: Point and Diffuse contamination. Point contamination includes the various contaminants released via discharges from discrete outlets, whereas diffuse contamination involves the contaminants entering the environment by a multiple of pathways when there is no discrete or identifiable point of discharge.Chhattisgarh is the tenth largest state of India with an area of 1, 35, 000 sq.km. The Bilaspur district containing the study area coming under this region exists in the North-West

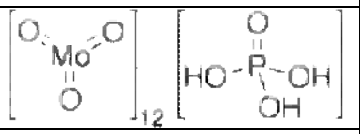
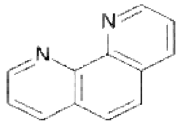
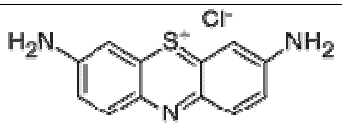
Routine sampling of various water systems

The water samples of antibiotic contaminated areas include various sites such as drained outflows of domestic sewage and hospital waste waters and other dumped sewage of veterinary hospital wastewater accumulation water sources as well as the medicinal and pharmaceutical industrial sewage areas of the Bilaspur district. The samples were collected from 8 sampling stations in 16 portions of 100 cm^3 amount, in the Erlenmeyer flasks respectively and the temperature and pH were recorded simultaneously.

Chemicals and reagents

All the chemicals used were of analytical grade and highest purity. Double distilled water was used for the dilution of the reagents and samples. Glacial acetic acid, Molybdenum-Thiocyanate, Carbontetrachloride (CCl_4), Chloroform ($CHCl_3$), Acetonitrile, Ethyl-acetate, Diethyl-Ether, Benzene, Toluene, Ferric Chloride ($FeCl_3$), Copper Sulfate ($CuSO_4$), 1,10 Phenanthroline and Thionin were from S.D. fine Chem Limited Mumbai, (AR Grade). Phosphomolybdic acid (PMA), sodium nitrate, methyl chloride, sodium nitrite, methanol, ethanol, ethyl acetate, sodium acetate, potassium iodate, sodium hydroxide, sulfuric acid (H_2SO_4), nitric acid (HNO_3) and hydrochloric acid (HCl) were from E-Merck Limited and Fluka. The antibiotic drugs such as Erythromycin stearate, Sulfamethoxazole dihydrochloride, Cefadroxil monohydrate, Amoxicillin trihydrate, Ciprofloxacin hydrochloride and Oxytetracycline dihydrate were from reliable companies such as Sigma Aldrich, Alkem lab Ltd. Mumbai, Aristo Pharmaceuticals Ltd. Mumbai and Ranbaxy, India. Alum [$K_2SO_4..Al_2(SO_4)_3.24H_2O$], and Activated Carbon (AC) were also supplied by S.D. Fine chemicals.

Table: 1.0 Properties of Chemical Reagents used

S.No.	Name of the compound/ Reagent	Formula	Molecular wt./ Molar mass	Structure
1	Phosphomolybdic acid (PMA)	$H_3PMo_{12}O_{40}$	1825.25g/mol	
2	1,10 Phenanthroline	$C_{12}H_8N_2$	180.20532 g/mol	
3	Thionin (Chloride)	$C_{12}H_{10}N_3SCl$	227.284 g/mol	

Apparatus and Equipments

(a) Instruments

A Systronics 118 UV-VIS double beam spectrophotometer with 1 cm quartz cell was used for the measurement of absorbance and other spectrophotometric measurements. The experiments were done at room temperature approx 25˚C. The pH measurements were made with a digital pH meter with suitable reference electrodes (Model 112E). High precision electrical balance (Dhona 200D) was used for weighing. A micro controller based instrument named nine parameter water analyzer kit model 371 was employed for measuring the various parameters of water. Throughout the experimental procedure conductometric measurements of conductance were made using a Systronics digital microprocessor based conductivity meter model 304 and the conductivity cell was calibrated with the KCl solutions in appropriate concentration range.

(b) Glass wares

Reaction Vessels: Flat bottom and glass stoppered (B-19 or B-24) tubes 6×1 were used and the reaction vessels were steam cleaned before use.

Burettes: Graduated Borosilicate glass burettes were used and 25×o.1 ml, 10×0.1 ml, 50×o.1 ml appropriate burettes were used for transfer of the reagents and distilled water.
Pipettes: Graduated pipettes and other micro pipettes were used for the appropriate measurements.

Beaker and Measuring Flasks: 10 ml, 25 ml, 50 ml, 100 ml, 250 ml, and 1000 ml measuring flasks and beakers of different volumes were employed for the measurements.

3. Experimental Procedure and Analysis

Preparation of Solution

The stock solutions of the chemicals were prepared by weighing the substances accurately in the electric balance. The reagent was dissolved in double distilled water to give 5×10^{-3} M stock solution. The solution was stored under cold and dark condition and the stability of the solution was monitored by measuring the absorption spectra in the visible region. The antibiotic drugs (sigma, purity > 99.0%) were dried at 50˚C under the reduced pressure until a constant mass was achieved before weighing. The antibiotic working solutions were further prepared by appropriate dilution of the stock solution with double distilled water. The concentration of a diluted stock solution however, decreases after allowing it to stand for one day. Hence, the working sample solutions were prepared immediately prior to the use by dilution of the stock solution accurately. The stock solution and the sample working solutions were kept in a refrigerator to avoid probable biodegradation. The double distilled de-ionized water was used throughout.

a. Standard solution: Stock solution of pure (1 mg/ml) of the antibiotic drugs were prepared by dissolving 50 mg into 100 ml calibrated standard flask with methanol. Then a working standard solution of the antibiotic drugs i.e. ERY, SFX, CFX, AMX, CIP, and OTC containing 25-250 µg/l were prepared by further dilution. These solutions were stored in a well closed vessels and the direct contact with light was avoided. The sample solutions were further prepared containing 0.5-6.5 µg/ml of ERY, 0.2-5.8 µg/ml of SFX, 0.5-7.0 µg/ml of CFX, 0.2-8.5 µg/ml of AMX, 0.5-5.0 µg/ml of CIP and 0.2-8.0 µg/ml of OTC in the different solvents.
b. PMA solution: A 0.05% solution of the phosphomolybdic acid (PMA) in (75:25) water ethanol mixture was prepared for use and stored in an amber glass bottle.
c. Reagent solution: The solution of 1,10 Phenanthroline 0.1% was prepared by dissolving 0.1 g of the reagent i.e. 1,10-Phenanthroline in 25 ml of methanol and made up to 100 ml with deionized double distilled water. Similarly, the solution of Thionin as a reagent was prepared, 0.5% $FeCl_3$ solution and 0.1 M sodium hydroxide was also prepared.
d. Filtration and Degassing: All working solutions employed were prior filtered and degassed by degassing unit.

Preparation of tablet-samples for analysis

Twenty tablets of each drug were weighed and finely powdered. The stock standard solutions were prepared by dissolving an accurately weighed amount of the powdered tablet contents equivalent to the active ingredient which was transferred into a 100 ml calibrated flask and dissolved in about 50 ml of methanol. The contents of the flask were swirled and then completed to the volume with methanol. The dispersions were thereafter filtered and used for sample analysis.

Analytical Procedure

Using Thionin as a Reagent:

Aliquots of sample solution containing 0.5-6.5 µg/ml of ERY, 0.2-5.8 µg/ml of SFX, 0.5-7.0 µg/ml of CFX, 0.2-8.5 µg/ml of AMX, 0.5-5.0 µg/ml of CIP and 0.2-8.0 µg/ml of OTC were transferred into a series of 25 ml calibrated flasks, 1 ml of 0.1 M sodium hydroxide were added and the mixture was kept on a water bath (80˚C) for 10 minutes after being cooled to room temperature (27±4˚C),1.5 ml of 0.1 M of the Potassium iodate , 2 ml of 1 M hydrochloric acid, $5x10^{-3}$ M molybdenum-thiocyanate reagent and 0.05% PMA solution were then added. The mixture was gently shaken until the appearance of yellow color, indicating the liberation of iodine. 1 ml of 0.1% of Thionin reagent solution was then added to it followed by the addition of 2 ml of 1 M acetate buffer of pH4 and the reaction mixture was shaken for 2 minutes. The contents were diluted up to 25 ml with distilled water and mixed well. The absorbance of the oxidized species formed was then measured at 465 nm against the reagent blank prepared in the same manner without the analyte. The amount of antibiotics, ERY, SFX, CFX, AMX, CIP and OTC present in the volume taken was computed from the calibration graph.

Using 1,10 Phenanthroline as a Reagent:

Aliquots of the sample solution containing 0.5-6.6 µg/ml of ERY, 0.4-5.4 µg/ml of SFX, 0.8-4.4 µg/ml of CFX, 1.0-7.6 µg/ml of AMX, 0.6-7.8 µg/ml of CIP, and 1.2-7.4 µg/ml of OTC were transferred into a series of 25 ml calibrated flasks, 1 ml of 0.1 M sodium hydroxide were added and the mixture was kept in a water bath (80˚ C) for 10 minutes after being cooled to room temperature (27±4˚ C), 1.5 ml of 0.1 M Potassium iodate, 2 ml of 1 M hydrochloric acid and 0.05% PMA solution were added. The mixture was gently shaken until the appearance of violet red color, indicating the liberation of iodine. 1ml of 0.1% of 1, 10 Phenanthroline reagent was then added to it followed by the addition of 2 ml of 1M acetate buffer of pH4 and the reaction mixture was shaken for 2 minutes. The contents were diluted up to 25 ml with distilled water and mixed well. The absorbance of the resulting solution was measured at 556 nm against distilled water. A blank was then prepared by replacing the analyte solution (ERY, SFX, CFX, AMX, CIP and OTC) with distilled water. The absorbance corresponding to the bleached color that in turn corresponds to the analyte concentration was obtained by subtracting the absorbance of the blank solution from that of test solution. The amount of ERY, SFX, CFX, AMX, CIP and OTC present in the volume taken was computed from calibration graph.

Analysis of the solution in water

An appropriate amount of each antibiotic was dissolved in water so as to prepare 1 mg/ml of solution and then the above procedure was again followed with the recommended procedure without any modifications. The presence of other substances caused no significant interference with the determination of antibiotics.

Analysis of the Formulations

A weighed amount of the sample equivalent to about 250 mg (0.2503g) of the antibiotic was taken and dissolved in a sufficient amount of distilled water. The solution was shaken and filtered through Whatman filter paper no.1 and then washed with water. The filtrate was diluted with distilled water and made up to 100 ml. The general procedure was then applied and then excipients in the sample caused no interference in the determination.

Measurement and analysis by spectrophotometric determination

10 ml aliquots of the antibiotic standard solution having varying concentrations were taken in a separating funnel. Molybdenum-Thiocyanate, 1, 10 Phenanthroline and Phosphomolybdic acid 100 µl each were added in the separating funnel followed by the addition of 5 ml ethyl acetate. The contents were shaken for 2 minutes and then allowed to settle for 3 minutes. The aqueous layer was discarded. The ethyl-acetatelayer was collected and 2.5 ml of this solution was used.

The colored organic layer of ethyl-acetate was directly used for the absorbance measurements at 556 nm against the reagent blank and the calibration graph was further prepared by plotting absorbance versus concentration of the antibiotics. The concentrations of antibiotics in the each sample solution were computed by using the calibration graph prepared under similar conditions. Again 20 ml of the sample solution was taken to which 100 µl of the reagent (5×10^{-3}M) and 100 µl of glacial acetic acid were added and the resultant solution with 1,10Ph was extracted with 10 ml of diethyl-ether, shaken for 2 minutes and allowed to stand for 3 minutes.

The same process was repeated and the resultant solution was then extracted with 10 ml of ethyl-acetate, shaken for 2 minutes and kept for 3 minutes followed by the isolation of organic layer and its subsequent measurement at 556 nm for its spectrophotometric determination. The above same procedure was repeated using Thionin as the reagent also and the absorbance was measured further at 456 nm. The absorbance was noted at the same wavelength and the difference of these two readings was considered as the absorbance.

Characteristic determination of the antibiotic drugs

An aliquot of the pure sample containing 1-10 ml working standard solutions of ERY, SFX, CFX, AMX, CIP and OTC were transferred into a series of 25 ml standard flasks. A volume of 3 ml of 0.5% $FeCl_3$ reagent solution was added to each flask. The content of the flasks was shaken well and kept aside for 5-10 minutes and the volume was adjusted with 0.1 N HCl. The absorbance was measured at 440 nm for ERY, 454 nm for SFX, CFX, AMX, 420 nm for CIP and 410 nm for OTC against corresponding reagent blank after 10 minutes. A calibration graph was drawn and the regression equation was further calculated.

Table 1.1 Analytical Characteristics by Spectrophotometric Method

Reagent Used	Procedure	Linear range (µg/ml)	Detection Limit (DL) (µg/ml)	RSD (%)
Phosphomolybdic Acid (PMA)	1-5 ml of stock solutions placed in 10 ml calibrated flask. Distilled water was added to give volumes upto 5 ml. Fresh reagent PMA (1 ml each) was then added to each flask before heating at 100˚C for 20 minutes. After cooling, the volumes were completed to 10 ml with water , mixed well before reading at 556 nm	2-12	0.6	<1%
1,10 Phenanthroline	1 ml of 1,10 Phenanthroline and 2.5 ml of sodium nitrate was mixed well and left to stand 10 minutes. Accurately measured aliquots of standard drugs each was (ERY, SFX CFX, AMX, CIP, OTC) followed by 1.5 ml of sodium hydroxide. Mixture allowed to stand for 5 minutes and then treated with 5 ml $CuSO_4$, 6 ml of 0.5 mol H_2SO_4 and extracted three times with a total volume of 25 ml of ethyl-acetate. Extracts were collected in 25 ml calibrated flasks and absorbance was measured at 556 nm	3-7	0.067	0.02%

Analysis of the pharmaceutical formulations in dosage form

Different brands of each antibiotic tablet of ERY, SFX, CFX, AMX, CIP and OTC were evaluated for their content of active ingredient. Weight uniformity test was carried out on each brand of the tablets. Twenty (20) tablets of each antibiotic drug were crushed, finely powdered and mixed separately. An accurately weighed quantity equivalent to 0.00237 M of each antibiotic drug respectively were transferred into a 100 ml standard flask and extracted with 3×25 ml methanol by magnetically stirring for 20 minutes, filtered and flasked with methanol again and completed up to the mark with same solvent. Then it was mixed well and diluted with distilled water so that the solution contains 25-250 µg/ml of these antibiotic drugs.

Determination of ERY, SFX, CFX, AMX, CIP, OTC Antibiotic Drugs in pure form

2 ml of 0.05% of PMA solution was added to 6 ml of 4M H_2SO_4, 0.2 ml of 0.1% 1,10 Phenanthroline and 0.1 ml of 0.5 % $FeCl_3$. Solutions were placed in a 100 ml separating funnel and the mixtures were left for 20 min at room temperature (25±5˚C). Then 1 ml of antibiotic drug solution (1mg/ml) (each of ERY, SFX, CFX, AMX, CIP and OTC) was added and diluted with de-ionized water to 20 ml and the reaction mixture was left for 20 minutes. The ion pairs were extracted with 5 ml portions of ethyl acetate twice after shaking for 1 minute. The ion pairs were collected

in a 10 ml measuring flask and methyl chloride was dried over anhydrous sodium sulfate and the absorbance of the filtered extract was measured. Similarly, without drugs, the same was prepared against a reagent blank.

70. Dr. JAYATI CHATTERJEE MITRA, Dr. NEENA RAI AND Dr. SANTOSH K. SAR,.FATE OF ANTIBIOTICS IN THE ENVIRONMENT: AN ANALYTICAL STUDY. Journal for Advanced Research in Applied Sciences; Pages: 64-77

4. Result and Discussion

Absorption Spectra

The absorption spectra of the extracted ion pairs in ethyl acetate were scanned in the suitable wavelength range against the reagent blank. The colored ion- pairs so extracted attained maximum absorption at 556 nm for all the drugs under study. The goal of this investigation was to find a simple, reliable and accurate method for the analytical determination of the antibiotic drugs under study in a routine work. The work incorporates the fact that the ion pairs are formed between the tertiary groups of antibiotic drugs (ERY, SFX, AMX, CFX, CIP and OTC) and the binary complex of the reagent via the prorogated nitrogen atom of the drugs.

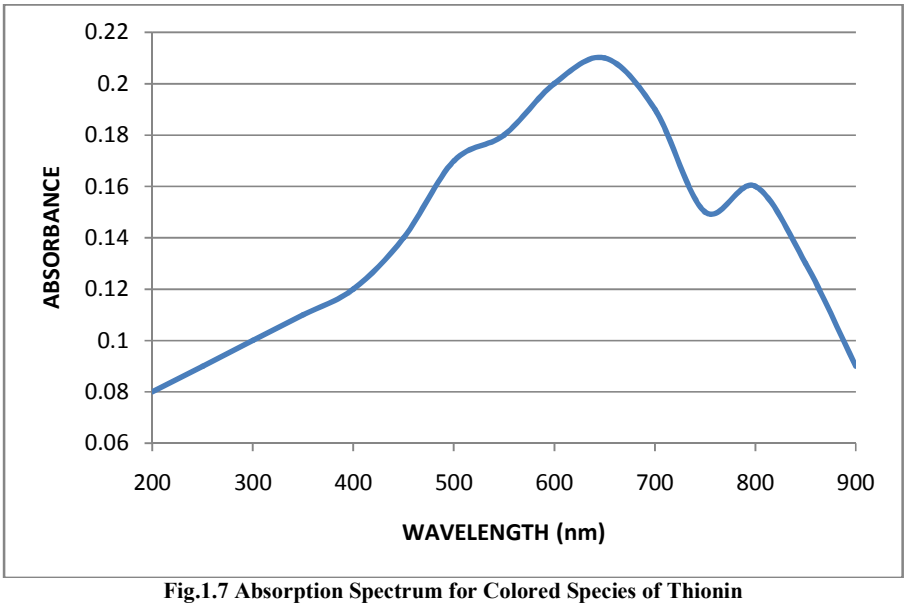


Fig.1.7 Absorption Spectrum for Colored Species of Thionin

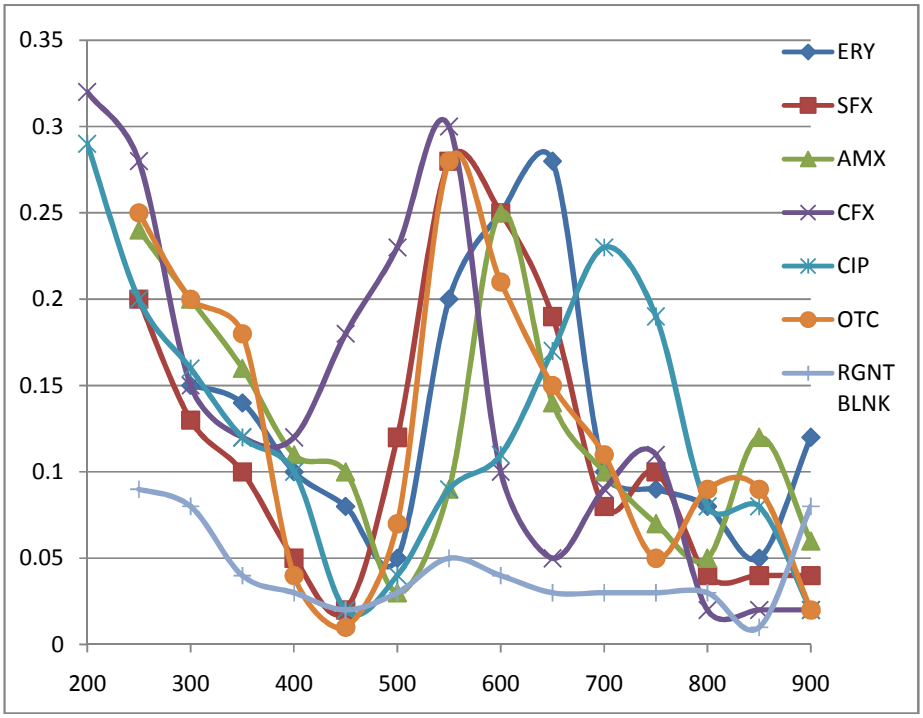
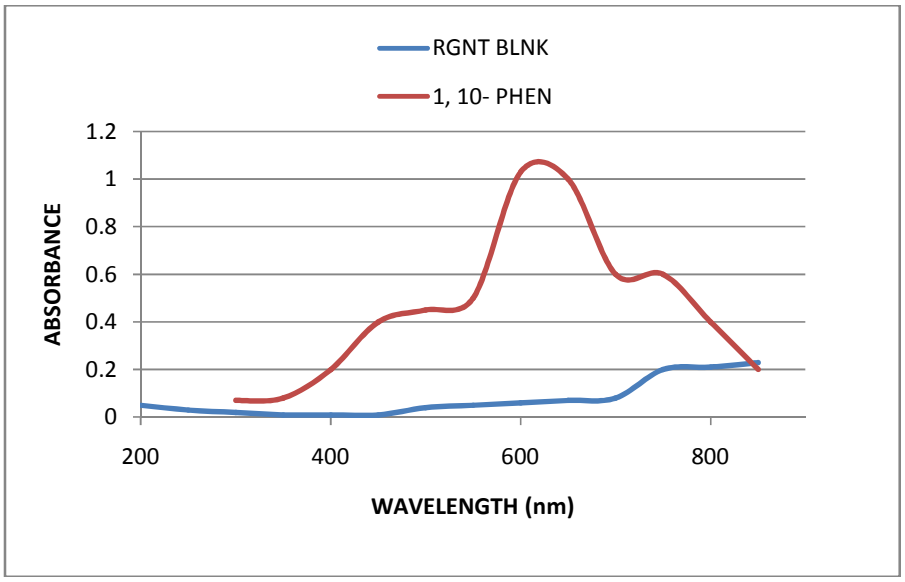


Fig. Absorption Spectra of Colored Species of 1,10-Phenanthroline with "ERY", "SFX", "AMX", "CFX", "CIP" and "OTC" against Reagent Blank

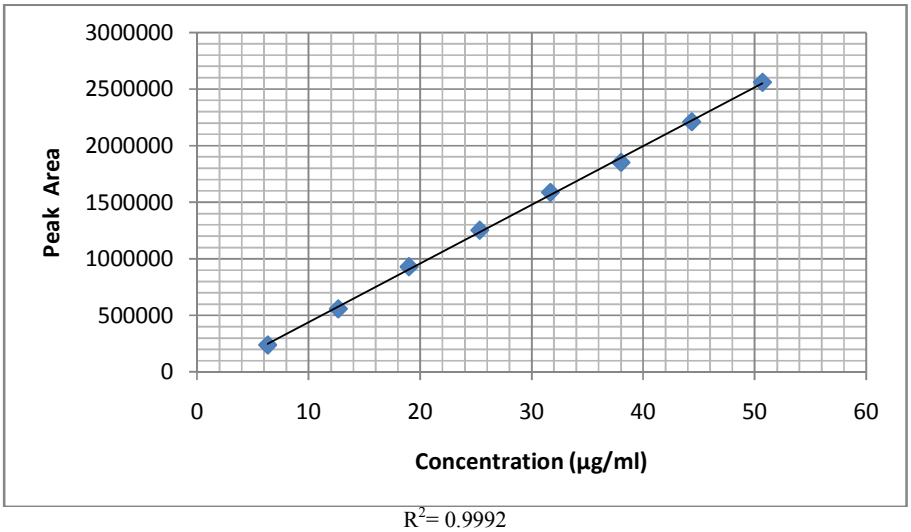


Absorption Spectrum of 1,10, Phenanthroline with Reagent Blank

Table 1.2 Linearity results of antibiotic concentration and peak area

S.No.	Linearity Level	Concentration (µg/ml)	Peak Area
1	25%	6.3374	238656
2	50%	12.6747	558701
3	75%	19.0122	931017
4	100%	25.3495	1253301
5	125%	31.6869	1587482
6	150%	38.0243	1852165
7	175%	44.3617	2211321
8	200%	50.6991	2560164

Therefore, the resultant coefficient variation from the above =0.9992



R^2= 0.9992

Fig. Linearity plot of antibiotics

Table: 1.3 Calibration of Different Antibiotics in Varying Concentration Range with Absorbance

CONCENTRATION (µg/ml)	ABSORBANCE					
	ERY	SFX	AMX	CFX	CIP	OTC
0.15	0.1	0.12	0.18	0.15	0.17	0.16
0.25	0.2	0.31	0.19	0.25	0.2	0.3
0.5	0.4	0.39	0.2	0.4	0.28	0.7
0.75	0.42	0.42	0.28	0.45	0.29	0.85
1.0	0.48	0.51	0.3	0.6	0.3	0.9
1.25	0.6	0.62	0.32	0.65	0.36	1.15
1.5	0.7	0.71	0.38	0.9	0.39	1.3
1.75	0.8	0.89	0.4	1.2	0.4	1.5
2.0	1	1.12	0.48	1.6	0.5	1.8

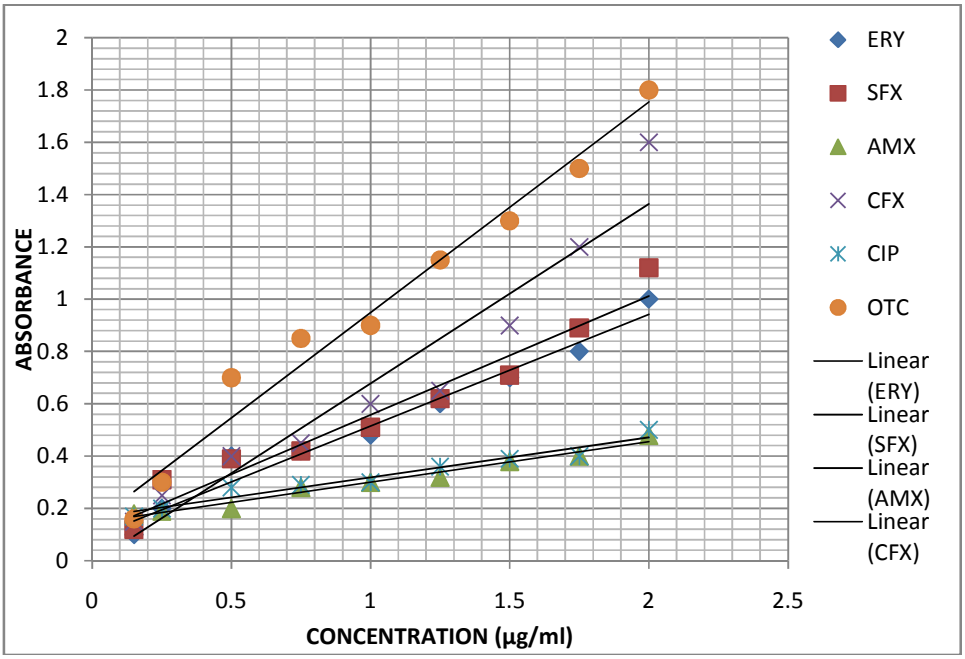


Fig. Calibration Curve of Different Antibiotics In Varying Concentration Range with Absorbance

Table:1.4 The effect of time on formation of ion – pairs

TIME (Min)	ABSORBANCE					
	ERY	SFX	AMX	CFX	CIP	OTC
00	0.72	0.51	0.60	0.53	0.65	0.70
5	0.77	0.53	0.63	0.61	0.69	0.71
10	0.69	0.55	0.64	0.62	0.69	0.67
15	0.68	0.58	0.65	0.63	0.68	0.66
20	0.68	0.56	0.66	0.65	0.65	0.65
25	0.68	0.66	0.54	0.55	0.64	0.65
30	0.67	0.52	0.59	0.54	0.65	0.63
35	0.67	0.51	0.59	0.54	0.65	0.62
40	0.67	0.51	0.59	0.54	0.65	0.61
45	0.67	0.51	0.59	0.54	0.65	0.61
50	0.66	0.50	0.58	0.53	0.64	0.60
55	0.65	0.49	0.57	0.52	0.63	0.59
60	0.65	0.49	0.57	0.52	0.63	0.59

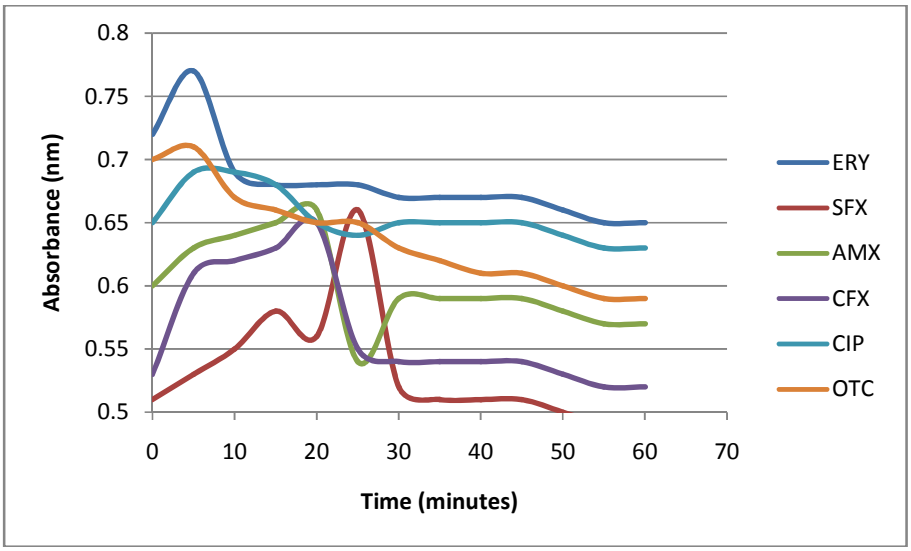


Fig. The effect of time on formation of ion - pairs

Table:1.5 The effect of temperature on formation of ion – pairs

Temperature	ABSORBANCE					
	ERY	SFX	AMX	CFX	CIP	OTC
25˚C	0.65	0.49	0.57	0.52	0.63	0.59
26˚C	0.65	0.49	0.57	0.52	0.63	0.59
27˚C	0.66	0.50	0.58	0.53	0.64	0.60
28˚C	0.67	0.51	0.59	0.54	0.65	0.61
29˚C	0.67	0.51	0.59	0.54	0.65	0.61
30˚C	0.67	0.51	0.59	0.54	0.65	0.62
31˚C	0.67	0.52	0.59	0.54	0.65	0.63
32˚C	0.68	0.66	0.54	0.55	0.64	0.65
33˚C	0.68	0.56	0.66	0.65	0.65	0.65
34˚C	0.68	0.58	0.65	0.63	0.68	0.66
35˚C	0.69	0.55	0.64	0.62	0.69	0.67
36˚C	0.77	0.53	0.63	0.61	0.69	0.71
37˚C	0.72	0.51	0.60	0.53	0.65	0.70

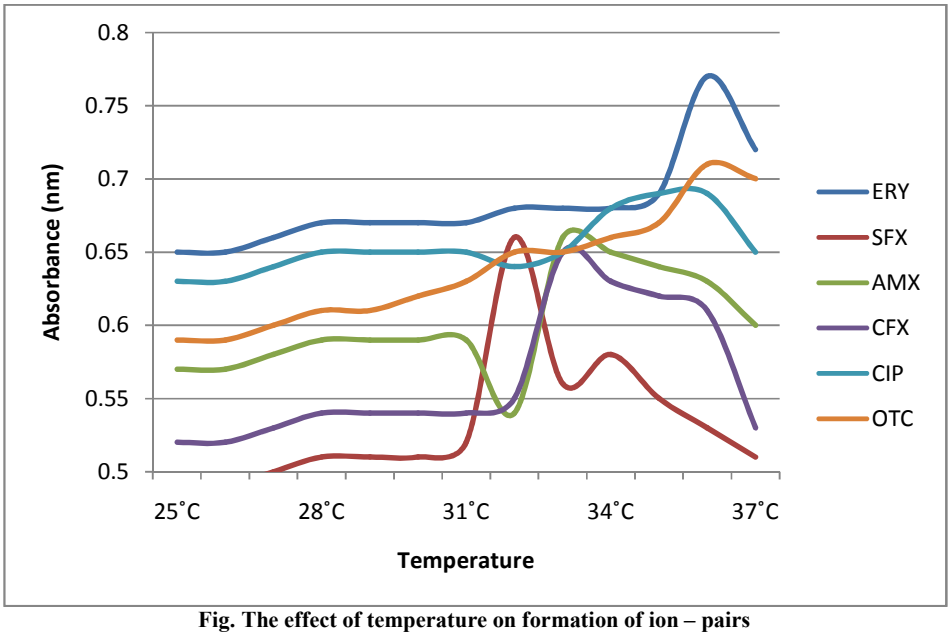


Fig. The effect of temperature on formation of ion – pairs

Effect of solvents

The solvents such as Ethyl acetate and Ether were used during the study to extract the various ion pairs quantitatively. Reproducible absorbance readings were obtained after double extraction with 10 ml of Ethyl acetate and 1 minute of shaking time. This gave higher absorbance and more than 10 ml of Ethyl acetateat one time for 1 minute. The intensity of the color formed after extraction is stable for at least 24 hours with 1,10 Phenanthroline rather than with Thionin.

Effect of Sodim Hydroxide Concentration

The effect of sodium hydroxide concentration on the absorbance is studied with 2 μgml^{-} of the antibiotics and the volumes from 0.2-2.8 ml of 0.1 M NaOH solutions were examined. The investigation showed and revealed that 1.2-1.8 ml of 0.1 M NaOH solution gave maximum absorbance and thus, the same volume of 0.1 M solution was chosen for the procedure further.

Stoichiometry of the formed ion pairs

The nature of the binding of $[Mo(SCN)_6]^-$ and PMA to each of the antibiotic drug in the presence of an excess amount of 1,10 Phenanthroline was determined by the molar ratio method to check the ratio between Mo and moiety of antibiotic drugs i.e., ERY, SFX, AMX, CFX, CIP and OTC to select the optimum conditions for their determination as stearate form, hydrochloride, dihydrochloride, monohydrate, dihydrate and trihydrate forms. The results indicate that 1:1 ratio of ion pairs are formed through the electrostatic attraction between the positive protonated drugs ERY^+, SFX^+, AMX^+, CFX^+, CIP^+, and OTC^+ and the phosphate negative complex.

Table:1.6 Analytical parameters of the method for the determination of ERY, SFX, AMX, CFX, CIP, OTC Antibiotic drugs for Molybdenum Thiocyanate (using PMA as a Colorimetric reagent)

PARAMETERS	ANTIBIOTIC DRUGS					
	ERY	SFX	AMX	CFX	CIP	OTC
λ_{max} (nm)	556	556	556	556	556	556
Concentration Range (µg/ml)	5-350	5-300	5-250	5-300	5-320	5-350
ε ($l\ mol^{-1}cm^{-1}$)	8.28×10^2	1.0×10^3	4.9×10^2	1.0×10^3	1.2×10^3	8.29×10^2
S ($\mu g\ cm^{-2}$)	0.004	0.004	0.01	0.003	0.003	0.01
M (A=mC + Z)	0.004	0.0103	0.005	0.005	0.005	0.005
Z	0.066	-0.011	-0.007	0.007	-0.002	0.068
r^2	0.999	0.998	0.999	0.999	0.999	0.999
Percent recovery	99.50-101.4	98.40-100.5	99.27-101.0	99.56-101.2	99.70-102.0	99.63-101.6
LOD ($\mu g\ ml^{-1}$)	2.60	1.02	2.10	2.10	2.10	2.60
LOQ ($\mu g\ ml^{-1}$)	8.80	3.40	7.02	7.02	7.02	8.40
SD	0.02-0.19	0.02-0.12	0.01-0.13	0.01-0.04	0.01-0.12	0.02-0.18
RSD (%)	0.20-2.98	0.24-3.20	0.27-3.10	0.14-2.90	0.20-3.50	0.24-3.24

LOD: Limit of Detection
LOQ: Limit of Quantization
RSD: Relative standard deviation

5. Conclusion

A rapid, quickly, fast, easy, simple, reliable, non destructive, less expensive and new procedure for the spectrophotometric determination of the antibiotics has been developed. The method is based on the potential of the PMA (Phosphomolybdic acid) inorganic agent (hetero-poly-acid) as the colorimetric reagent with Molybdenum-Thiocyanate $[Mo(SCN)_6]^-$ which is used as the ion- pairing agent with the antibiotic drugs along with the simultaneous use of 1,10-Phenanthroline and Thionin. Spectrophotometry, is found to be most attractive approach because it provides a simple, precise, easy, rapid, accurate and reliable measurements of the suitable analysis. All the methods described before in the literature needs a lot of time or needs sophisticated instrumentation, expertise and feels to be complicated enough. But, this current study with the present work includes easy method with rapid progress which used the simple and sensitive spectrophotometric technique to identify the major antibiotic-pollutant spots, the source and the points of aquatic area with antibiotic spread that would be helpful in identifying and determining not only the potential sources of contamination but also the reasons embarking the mobility of the antibiotic spread. Further, the present work also tends to determine the viability of these potential applications of antibiotic contamination study in aquatic environment. The spectrophotometric analytical determinations are based on the reduction of PMA (phosphomodybdic acid) by the compounds generated after the acid hydrolysis of antibiotics. The generation of these compounds from antibiotics is produced under acidic medium, being the characteristic degradation product. The oxidized and reduced forms of phosphomolybdic acid can be quantitatively adsorbed on the natural adsorbents from aqueous solutions, in a similar process to the extraction with ethyl acetate. The correlation coefficient for the antibiotic drugs are found to be 0.9954, 0.9959, 0.9928, 0.9955, 0.9942, and 0.9946 for ERY,CIP, OTC, AMX,CFX,SFX respectively.

The method is significantly applicable in the determination of the antibiotics in the water samples. The method so developed is found very simple as there is no any kind of requirement of various steps and the reagents so used are cheap and available commonly in the routine laboratories. All the steps used can minimize the cost of analysis and the results so obtained from the proposed method are found to be comparable with the established methods. Hence, the method involves good potential in simplicity, sensitivity and reproducibility.

REFERENCES

- Adams, C.; Wang, Y.; Loftin, K.; and Meyer, M. (2002), Removal of antibiotics from surface and distilled water in conventional water treatment processes. Journal of Environmental Engineering 128:253-260.
- Andreozzi, R.; Raffaele, M.; Nickolas, P.; (2003), Pharmaceuticals in STP effluents and their solar photodegradation in aquatic environments, Chemosphere 50 (10):1319-1330.
- Abbas, M.N. (2003). Diffuse reflectance spectroscopic determination of phosphate with applications of chromaticity coordinates and colour temperature. Anal. Sci. 19:1303-1308.
- Abraham, E.P.; Chain, E.; Baker, W. and Robinson, R. (1943). Penicillamine, a characteristic degradation product of penicillin. Nature, 151:107.
- Al.Ahmad, A.S.; Rahman, N. and Islam, F. (1999). Spectrophotometric determination of ampicillin, amoxicillin and carbenicillin using Folin-Ciocalteu phenol reagent. J. Anal. Chem. 59:119-123.
- Amin, A.S.; El-Ansary, A.L. and Issa, Y.M. (1994). Colorimetric determination of amoxicillin in pure form and in pharmaceutical preparations. Talanta, 41:691-694.
- Araj (2003). Pyrocatechol violet in pharmaceutical analysis. Part I-A spectrophotometric method for the determination of some B-lactum antibiotics in pure form and in pharmaceutical dosage forms. Farmaco. 56:211-218.
- Aitcheson, S. J.; Arnett, J.; Murray, K. R. and Zhang, J.; (2001), Removal of aquaculture therapeutants by carbon adsorption 2: Multicomponent adsorption and the equilibrium behaviour of mixtures. Aquaculture 192:249–264.
- Anderson, E., and N. Datta. **(**1994). Resistance to penicillins and its transfer in Enterobacteriaceae. Lancet 20:407-409.
- Arena, M.P.; Porter, M.D. and Fritz, J.S. (2002). Rapid, specific determination of iodine and iodide by combined solid-phase extraction/diffuse reflectance spectroscopy. Anal. Chem. 74:185-190.
- Abedini S.; Namdari, R. and Law, F. C. P.; (1998), Comparative pharmacokinetics and bioavailability of oxytetracycline in rainbow trout and chinook salmon, Aquaculture 162:23–32.
- Aliaga, J. F., and F. W. Goldstein. **(**2001). Trends in bacterial resistance to fluoroquinolones. Clin. Infect. Dis. 24:S67-S73.
- Ashton, D.; Hilton, M.; Thomas, K.V.; (2004), Investigating the environmental transport of human pharmaceuticals to streams in the United Kingdom, Science of the Total Environment 333:167–184.
- Batt, A.L.; Snow, D.D.; Aga, D.S.; (2006). Occurrence of sulfonamide antimicrobials in private water wells in Washington County, Idaho, USA. Chemosphere 64:1963–1971.
- Bhattacharya, S.; Roy, S.K. and Chakraborty, A.K. (1990). Spectrophotometric determination of traces of iron after extraction of iron(II)-phenanthroline complex of polyurethane foam. Talanta, 37:1101-1104.
- Belter, T. and Farag, A.B. (1983). The recovery of gold from alkaline cyanide media with a polyurethane foam sorbent. Anal. Chim. Acta, 153:319-329.
- Bowen, H.J.M. (1970). Absorption by polyurethane foams; new method of separation. J. Chem. Soc. A. 1082-1085.
- Bendz, D.; Paxeus, N.A.; Ginn, T.R.; Loge, F.J.; (2005). Occurrence and fate of pharmaceutically active compounds in the environment, a case study: Hoje River in Sweden. Journal of Hazardous Materials 122:195–204.
- Baquero, F., and Blazquez, J.; **(**1997). Evolution of antibiotic resistance. Trends Ecol. Evol. 12:482-487.
- Baquero, F., J. Martinez-Beltran, and E. Loza. **(**1991). A review of antibiotic resistance patterns of Streptococcus pneumoniaein Europe. J. Antimicrob. Chemother. 28(Suppl. C):31-83.
- Björklund, H.V., and G. Bylund. (1990). Temperature-related absorption and excretion of oxytetracycline in rainbow trout (Salmo gairdneriR.). Aquaculture 84:363–372.
- Balcioglu and Otker,(2003). Molecular characterization of plasmid-mediated oxytetracycline resistance in Aeromonas salmonicida. Appl. Environ. Microbiol. 64:4194-4201

- Balcioglu and Otker, (2002). Oxytetracycline residues in a freshwater recirculating system. Aquaculture 205:221–230.
- Barber, L.B.; Murphy, S.F.; Verplanck, P.L.; Sandstrom, M.W.; Taylor, H.E.; Furlong, E.T. (2006). Chemical loading into surface water along a hydrological, biogeochemical, and land use gradient: A holistic watershed approach. Environmental Science & Technology 40: 475-486.
- Brown, K. D.; Kulis, J.; Thomson, B.; Chapman, T. H.; Mawhinney, D. B. (2006). Occurrence of antibiotics in hospital, residencial, and dairy effluent, municipal wastewater, and the Rio Grande in New Mexico. Science of the Total Environment 366 (2-3): 188-192.
- Chow, A.; Branagh, W. and Chance, J. (1990). Sorption of organic dyes by polyurethane foam. Talanta, 37:407-412.
- Campbell, C.G.; Borglin, S.E.; Green, F.B.; Grayson, A.; Wozei, E.; Stringfellow, W.T. (2006). Biologically directed environmental monitoring, fate, and transport of estrogenic endocrine disrupting compounds in water: a review. Chemosphere 65:1265-1280.
- Choi, S.M.Y.; Sun D.L.; Byung M. (2004). Toxicological characteristics of endocrine disrupting chemicals: developmental toxicity, carcinogenicity, and mutagenicity. Journal of Toxicology & Environmental Health: Part B (7): 1-32.
- Christakos, G.; Bogaert, P.; Serre, M.L. (2000)a. Spatiotemporal study of environmental exposure-health effect associations. Journal of Exposure Analysis and Environmental Epidemiology 10 (2): 168-187.
- Chen Y.; Han, F.M. and Yuan, Z.B.; (1995) Single sweep polarographic analysis of ciprofloxacin, Fenxi Kexue Xuebao 11:55-7.
- Chin, T.F. and J. L. Lach; (1975). Drug diffusion and bioavailability: tetracycline metallic chelation. American Journal of Hospital Pharmacy 32:625–629.
- Carbella, et. al., (2004). Chemistry of tetracyclines. Quarterly Review of the Chemical Society. 22:435–457.
- Chowdary KPR and Rama Prasad YV (1994) Spectrophotometric estimation of ciprofloxacin hydrochloride in dosage forms and in dissolution rate studies, Indian Drugs43, 277-9.
- Daughton,C.G.; Ternes,T.A.; (1999). Pharmaceuticals and personal care products in the environment: agents of subtle change? Environmental Health Perspectives, 107: 907–938.
- Debska, A.M., and M.K. Stoskopf. (2004). The kinetics of oxytetracycline degradation in deionized water under varying temperature, pH, light, substrate, and organic matter. Journal of Aquatic Animal Health 12: 246–253.
- Demitrienko and Zolotov.; (2002). Study on the determination and electrode mechanism of ciprofloxacin by LSP, Fenxi Shiyanshi 14:33-6.
- Erickson, B.E.; (2002). Analyzing the ignored environmental contaminants. Environ. Sci. Technol. 36:140A-145A.
- Finlay-Moore, O.; Hartel; P. G.; Cabrera, M. L. (2000). 17-estradiol and testosterone in soil and runoff from grasslands amended with broiler litter. Journal of Environmental Quality 29 (5): 1604-1611.
- Fritz, J.S.; Arena, M.P.; Steiner, S.A. and Porter, M.D.; (2003). Rapid determination of ions by combined solid-phase extraction-diffuse reflectance spectroscopy. J. Chromatogr. A. 997:41-50.
- Ghidini, S.; Zanardi, E.; Varisco, G. and Chizzolini, R.; (2002). Prevalence of molecules of B-lactum antibiotics in bovine milk in Loombardia and Emilia Romagna. Ann. Fac. Medic. Vet. Di Pharma 22:245-252.
- Gobel, A., McArdell, C.S., Suter, M.J.F., Giger, W., (2004). Trace determination of macrolide and sulfonamide antimicrobials, a human sulfonamide metabolite, and trimethoprim in wastewater using liquid chromatography coupled to electrospray tandem mass spectrometry. Analytical Chemistry 76: 4756–4764.
- Halling-Sorrensen, B., A. Lykkeberg,, F. Ingerslev, P. Blackwell, and J. Tjrrnelund. (2003). Characterization of the abiotic degradation pathways of oxytetracyclines in soil interstitial water using LC-MS-MS. Chemosphere 50:1331–1342
- Halling-Sørensen, B., Nors Nielsen, S., Lanzky, P.F., Ingerslev, F., Holten Lu¨tzhøft, H.C., Jørgensen, S.E., (1998). Occurrence, fate and effects of pharmaceutical substances in the environment – a review. Chemosphere 36:357–393.
- Heberer, T., (2002). Occurrence, fate, and removal of pharmaceutical residues in the aquatic environment: a review of recent research data. Toxicology Letters 131:5–17.
- Hirsch, R., Ternes, T.A., Haberer, K., Mehlich, A., Ballwanz, F., Kartz, K., (1998). Determination of antibiotics in different water compartments via liquid chromatography–electrospray tandem mass spectrometry. Journal of Chromatography A 815:213–223.

- Hirsch, R., Ternes, T., Haberer, K., Kratz, K.L, (1999). Occurrence of antibiotics in the aquatic environment. Science of the Total Environment 225:109–118.
- Issopoulos, P.B. (1989). Spectrophotometric determination of certain cephalosporins using molybdophosphoric acid. Part II-Determination of cefadroxil, cefapirin, ceforanide and cefuroxime. Analyst. 114:237-239.
- Isidori, M.; Lavorgna, M.; Nardelli, A.; Pascarella, L.; Parrella, A. (2005). Toxic and genotoxic evaluation of six antibiotics on non-target organisms. Science of the Total Environment 346: 87-98.
- Ingerslev, F., L. Toräng, M-L. Loke, B. Halling-Srrensen, and N. Nyholm. (2001). Primary biodegradation of veterinary antibiotics in aerobic and anaerobic surface water simulation systems. Chemosphere 44:865–872.
- Jacobsen, P., and L. Berglind. 1988. Persistence of oxytetracycline in sediments from fish farms. Aquaculture 70:365–370.
- Kummerer, K. and Henninger, A.; (2001). Promoting resistance by the emission of antibiotics from hospitals and households into effluent. Clinical Microbiol. Infect. 9:1203-1214.
- Kolpin, D. W., E. T. Furlong, M. T. Meyer, E. M. Thurman, S. D. Zaugg, L. B. Barber, and H. T. Buxton. (2002). Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams: A national reconnaissance. Environmental Science and Technology 36:1202–1211.
- Katsoulis, D.E.; (1998). A Survey of applications of polyoxometalates. Chem. Rev. 98:359-387.
- Lindberg, R.H.; Bjorklund, K.; Rendahl, P.; Johansson, M.I.; Tysklind, M.; Anderson, B.A.V. (2007). Environmental risk assessment of antibiotics in the Swedish environment with emphasis on sewage treatment plants. Water Research 41: 613-619.
- Lindsey, M.E., Meyer, M., Thurman, E.M., (2001). Analysis of trace levels of sulfonamide and tetracycline antimicrobials in groundwater and surface water using solid-phase extraction and liquid chromatography/ mass spectrometry. Analytical Chemistry 73, 4640–4646.
- McArdell, C.S., Molnar, E., Suter, M.J.F., Giger, W., (2003). Occurrence and fate of macrolide antibiotics in wastewater treatment plants and in the Glatt Valley Watershed, Switzerland. Environmental Science and Technology 37, 5479–5486.
- Petrovic, M.; Hernando, M.D.; Silvia D.; Az-Cruz, M.; Barcelo, D.; (2003). Liquid chromatography–tandem mass spectrometry for the analysis of pharmaceutical residues in environmental samples: a review. Journal of Chromatography A 1067, 1–14.
- Richardson, B.J.; Lam, P.K.S.; Martin, M.; (2003). Emerging chemicals of concern: pharmaceuticals and personal care products (PPCPs) in Asia,
- Robert, M. and N. H. Spliid. (2006). Sorption and mobility of metronidazole, olaquindox, oxytetracycline and tylosin in soil. Chemosphere 40:715–722.
- Salem, H. and Saleh, G.A. (2002). Selective spectrophotometric determination of phenolic B-lactum antibiotics. J. Pharm. Biomed. Anal. 28:1205-1213.
- Sanmtiago de Jesus, D.; Carvalho, M.S.; Spindola, A.C. and Costa, S.L. (1998). Quantitative separation of zinc traces from cadmium matrices by solid-phase extraction with polyurethane foam. Talanta 46:1525-1530.
- Sedlak, D. and Pinkston, K.E. (2001). Factors affecting the concentration of pharmaceuticals released to the aquatic environment. Water Res. Update. 120:56-64.
- Sjolund, D. A.; Pinck, L. A. and Allison, F. E., (2004). Antibiotics in soil and Further studies on release of antibiotics from clays. Soil Science 92:90–93.
- Takeba, K.; Fujinuma, K.; Miyazaki, T. and Nakazawa, H. (1998). Simultaneous determination of B-lactum antibiotics in milk by ion-pair liquid chromatography. J. Chromatography. A. 812:205-211.
- Vaughan, S., and P. Smith. (1996). Estimation of the influence of a river sediment on the biological activity of oxytetracycline hydrochloride. Aquaculture 141:67–76.
- Walsh, C. (2003). Antibiotics: actions, origins, resistance. ASM Press, Washington, USA.
- Walter, P. J., M. L. Andrew, and W. W. Wright. (1985). Solubility of antibiotics in twenty-four solvents: Use in analysis. Antibiotics and Chemotherapy 7:374–377.

❖ Wollenberger, L., B. Halling-Soerensen, and K. O. Kusk. (2000). Acute and chronic toxicity of veterinary antibiotics to Daphnia magna. Chemosphere 40:723–730.

A Review on Spectrophotometric Determination of Pesticide.

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INTRODUCTION

In recent years, the total amount of pesticides used has increased worldwide. In Thailand, the Department of Agriculture (DOA) reported that pesticides were increased 1.2 fold in 5 year time from 110,000 tons in 2008 to 134,000 tons in 2013. The major abundant was herbicides, insecticides and fungicides, respectively [1] Pesticide present in trace contamination in the natural aquatic systems. Toxicity of pesticides produces a large scale of pollution problem. In vegetable growing and its residue was detected Carbendazim as a fungicide widely used. Trace contamination of pesticides present in the natural aquatic systems creates a lot of pollution problem due to their toxicity and bioaccumulation property[2, 3]. The common used analytical techniques for the analysis of carbendazim include liquid chromatography with UV [4, 5], diode-array [6], fluorescence [7, 8] or mass spectrometric detections [9]. Various extraction solvents such as acetone [10], acetonitrile [11], methanol [4], ethyl acetate [12], and dichloromethane [13] have been used to extract carbendazim residue followed by homogenizing, and shaking by using sonication [12].Carbendazim is toxic to humans, animals and plants. The toxicity produces Carbendazim is toxic to humans, animals and plants. The toxicity produces rapid effects on meiotic spermatocytes and latent effects on spermatids, leading to morphological abnormalities and failure of spermatogenesis [14]. It was also found that subchronic administration of carbendazim induced testicular alterations, spermatogenesis activity and embryotoxicity [15].Carbendazim is reported as one of the most commonly detected pesticides in fruits. According to the Indian agriculture department we should use pesticide under the given unit of percentages in Indian cash crops as well as internal crops.. It is often affected by depositing its residues on the surface of the plants, and which are consequently entrained by absorption within some parts of the plant. In China, for example, residues of carbendazim are found up to the level 1 mg/L in fruits [16]. Therefore, we are using different types of innovative and effective analytical method to developed our country in the field of agriculture In the present age we observed that pesticide or other chemical can be harm on crops so at last of this topic we can say that pesticide use in trace amount

A COMPARISION OF SPECTOPHOTOMETRIC METHOD OF CARBENDAZIM

El HadjiTombéBodian et al was developed an analytical method for the determination of carbenadazim fungicides large linear dynamic range (LDR), low limit of detection (LOD) and limit of quantification (LOQ) values of 0.07-0.7 ng/mL and 0.2-2.3 ng/mL, respectively, and small relative standard deviation (RSD) values less than 2%, according to the medium.[17]

Purushotham Naidu et al has developed two simple, sensitive, rapid, accurate and precise spectrophotometric methods for the analysis of parts per million levels of widely used carbamate pesticide Carbendazim. The first proposed method A is based on the Oxidation followed by complex formation product with 2,2-Bipyridyl – Fe(III) to form orange colored chromophore exhibiting absorption maximum at 512 nm with apparent molar absorptivity 3.82x103 L mol1cm-1 and obeyed Beer's law in the concentration range of 10 - 60µg/ml. The second method B is based on the extraction of pesticide and potassium Ferricynide - Fe (III) to form bluish green colored product exhibiting absorption maximum at 478 nm with apparent molar absorptivity 4.46x103 L mol-1cm-1 and obeyed Beer's law in the concentration range 4- 40 µg/ml. The high percent recoveries indicates the accuracy and reliability of the validate methods .[18]

Buran Phansawan et al has developed method provided good recoveries of carbendazim from spiked pooled vegetable samples ranged from 92.5 % to 96.0 % with the relative standard deviation (RSD) of 2.1 % to 5.9 % at spiked levels of 0.05-0.30 mg kg-1. The limit of detection (LOD: 0.003 mg kg-1) as well as the limit of quantitation (LOQ: 0.030 mg kg-1) of the developed method is sensitive to detect carbendazim residue in vegetables far below the Codex Maximum Residue Limits (MRLs) such as 0.05 mg kg-1 set for cucumber.

CONCLUSION:

A simple , reliable and sensitive spectrophotometric analytical method has developed by El HadjitombeBodian et al. This method is easy to applied on carbendazim treated fields. This method is also applied on lowest concentration of carbendazim detected (0.07 and 0.07 ng/mL) for quantitative analysis of fungicide residues in an aqueous environment. Purushotham Naidu et al has also reported an analytical application to the determination of carbendazim residues through UV and Visible spectrophotometric methods. This methods are decisive and advantageous. Since interference from the excipients should be far less at higher wavelength. This method indicated a good recoveries of the pesticides. These proposed methods were applied in quality control laboratories and also applied for routinr analysis.. Buran Phansawan et al has developed a sensitive method using high performance liquid chromatography-UV detection (HPLC-UV) for determining carbendazim residue in vegetables. Carbendazim residue determine in vegetables with LOD far below the codex MRL This method showed to be sensitive This method is also fast, simple with good recovery rate (92-96%) and employs only 5 g of sample for analysis.

REFERENCE:

1. DOA. “Import agricultural chemical report 2012.” Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok, Thailand, 2013. Available at http://www.doa. go.th. Accessed 31 July 2013.
2. Manisankar, P., Selvanathan, G., Viswanathan, S., GurumalleshPrabu, H., Electrochemical determination of some organic pollutants using wall – jet electrode, Electroanalysis, 2002, 14 (24), 1722.
3. Lagaly, G., Pesticide–clay interactions and formulations, Appl. Clay Sci, 2001, 18, 205.
4. Veneziano A., Vacca G., Arana S., De Simone F. and Rastrelli L., Determination of carbendazim, thiabendazole and thiophanate-methyl in banana (Musa acuminata) samples imported to Italy, Food Chem., 2004; 87: 383-386. DOI 10.1016/j.foodchem.2003.12.009
5. Al-Ebaisat H., Determination of some benzimidazole fungicides in tomato puree by high performance liquid chromatography with SampliQ polymer SCX solid phase extraction, Arab J. Chem., 2011; 4: 115-117. DOI 10. 1016/j.arabjc.2010.06.027.
6. Michel M. and Buszewski B., Optimization of a matrix solid-phase dispersion method for the determination analysis of carbendazim residue in plant material, J. Chromatogr. B, 2004; 800: 309-314. DOI 10.1016/j.jchromb. 2003.08.039.
7. Hu Y., Yang X., Wang Z., Wang C. and Zhao J., Determination of carbendazim and thiabendazole in tomatoes by solid-phase microextraction coupled with high performance liquid chromatography and fluorescence detection, Chin. J. Chromatogr., 2005; 23(6): 581-4. [13]
8. Wu Q., Li Y., Wang C., Liu Z., Zang X., Zhou X. and Wang Z., Dispersive liquidliquidmicroextraction combined with high performance liquid chromatography-fluorescence detection for the determination of carbendazim and thiabendazole in environmental samples, Anal. Chim. Acta, 2009; 638: 139-145. DOI 10. 1016/j.aca.2009.02.017.
9. Blasco C., Font G. and Pico Y., Evaluation of 10 pesticide residues in oranges and tangerines from Valencia (Spain), Food Control, 2006; 17: 841846. DOI 10.1016/j.foodcont.2005. 05.013. [15]
10. Nemeth-Konda L., Fuleky G., Morovjan G. and Csokan P., Sorption behaviour of acetochlor, atrazine, carbendazim, diazinon, imidacloprid and isoproturon on Hungarian agricultural soil, Chemosphere, 2002; 48: 545-552. DOI 10.1016/S0045-6535(02)00106-6.

11. Romero-Gonzalez R., GarridoFrenich A. and Martinez Vidal J.L., Multiresidue method for fast determination of pesticides in fruit juices by ultra performance liquid chromatography coupled to tandem mass spectrometry, Talanta, 2008; 76: 211-225. DOI 10.1016/j.talanta.2008. 02.041.
12. Pan J., Xia X.X. and Liang J., Analysis of pesticide multi-residues in leafy vegetables by ultrasonic solvent extraction and liquid chromatographytandem mass spectrometry, Ultrason. Sonochem., 2008; 15: 25-32. DOI 10. 1016/j.ultsonch.2007.06.005.
13. Hiemstra M. and de Kok A., Comprehensive multi-residue method for the target analysis of pesticides in crops using liquid chromatographytandem mass spectrometry, J. Chromatogr. A, 2007; 1154: 3-25. DOI 10.1016/j.chroma.2007. 03.123.
14. Akbarsha M.A., Kadalmani B., Girija R., Faridha A. and Hamid K.S., Spermatotoxic effect of carbendazim, Indian J. Exp. Biol., 2000; 39: 921-924.
15. Jia L., Garza M., Wong H., Reimer D., Redelmeier T., Camden J.B. and Weitman S.D., Pharmacokinetic comparison of intravenous carbendazim and remote loaded carbendazim liposomes in nude mice, J. Pharm. Biomed. Anal., 2002; 28: 6572. DOI 10.1016/S0731-7085(01) 00702-6.
16. Fernandez M, Rodriguez R, Pico Y, Manes J. Liquid chromatographic-mass spectrometric determination of post harvest fungicides in citrus fruits. J. Chromatograph A. 2001;912:301-310.
17. El HadjiTombé Bodian1, Ibrahima Sarr1, Souleymane Sambou1, Alphonse Mendy1, CoumbaGueye.,Spectrophotometric Method for the Determination of Carbendazim in Orange Juice Samples Marketed in Senegal ., Chemical Science International Journal .,21(1): 1-7, 2017; Article no.CSIJ.37770 ISSN: 2456-706X
18. Purushotham Naidu K, Niranjan T and V. S. NaiduN.,Spectrophotometric determination of Carbendazim in its Formulations and Environmental samples .,International Journal of ChemTech Research CODEN(USA): IJCRGG .,Vol.3, No.4, pp 1728-1733, Oct-Dec 2011
19. Buran Phansawan , TippawanPrapamontol.,A Sensitive Method for Determination of Carbendazim Residue in Vegetable Samples Using HPLC-UV and Its Application in Health Risk Assessment.,Chiang Mai J. Sci. 2015; 42(3) : 681-690

Ind. J. of Landscape Systems and Ecological Studies 42 (1) June - 2019, 140- 152 ISSN 0971-4170

Performance of Unorganized Powerloom Industry in India: A Review

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Abstract : *Unorganized powerloom industry is one of the oldest and largest industries in India and it plays an important role in textile sector in terms of fabric production and employment generation. It provides employment to 64.36 lakh persons, both skilled and unskilled workforce in India. It contributes to 60 percent of total cloth production in the country. About 60 percent of the fabrics produced in the powerloom industry are man-made and are exported to far off countries. There are approximately 25.74 lakh powerlooms distributed through out the country. Further, technologically the industry varies from plain loom to high-tech shuttle less looms. There are approximately 1.50 lakh shuttle less looms in this industry. As the industry have close linkage to agriculture and ancient culture and traditions of the country, it makes the Indian textiles industry unique in comparison with other industries. Keeping in view the present status of powerloom industry in India, an attempt has been made in this paper to present on overview of its growth and distribution in India and evaluate various government schemes to promote this industry. The paper is based on data of secondary sources collected from different institutions and organizations. The finding of this paper will help to study historical evolution, growth and distribution of powerloom industry in India and suggest suitable measures for regularization of unorganized powerloom industry.*

Keywords : *Unorganized powerloom industry, shuttle less powerloom, weaving process, cloth production in India*

Introduction

Industrialization is a processes of economic development in which a growing part of the national resources are mobilized to develop a technically up-to-date diversified domestic economic structure, which is characterized by a dynamic manufacturing sector (Senthilkumar and Rajendran, 2014). India than in compare to other countries has less developed not only because of low technological adoption, decline in growth of production, poor performance of foreign export and FDI but also due to mushrooming of unorganized industrial sector in the last few decades which have hindered in the development and growth of the economy.

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Powerloom industry is predominantly an unorganized sector. Powerloom industry is considered to be a branched out sector of the handloom sector. Webster defines a "*loom*" as a frame or machine for interweaving yarn or threads into fabric, the operation being performed by laying lengthwise a series called the "*warp*" and weaving in across this order threads called the "*weft*", woof, or filling (GoI, 2016). The close linkage of the industry to agriculture and the ancient culture, and traditions of the country make the Indian textiles sector unique in comparison with the textiles industry with the other countries (Muthu, 2015). Unorganized powerloom industry is one of the oldest and largest industries in India and plays an important role in textile sector in term of fabric production and employment generation. It provides employment to 64.36 lakh person, both skilled and unskilled workforce in India. It contributes to 60 percent of total cloth production in the country.

About 60 percent fabric produced in powerloom industry is man-made and is exported to far off countries. The readymade garments and home textile sector are heavily dependent on powerloom industry to meet their fabric requirement. There are approximately 25.74 lakh powerlooms distributed through the country. Further, technologically the industry varies from plain loom to high-tech shuttle less loom. There are approximately 1.50 lakh shuttle less looms in this country (GoI, 2016). But very few weavers have shifted to shuttle less loom in unorganized sector because of economic factor. To increase cloth production and maintain quality as per the global market it is important to overview the pattern of growth and distribution of powerloom industry in India and outline the major controlling factors of its evolution and give suggestive measures to promote and regularize the unorganized powerloom sector in India. The present study is based on secondary data collected from different sources, journals, publications and reports. Further, organizations like Ministry of Textile and Office of the Textile Commissioner has been visited to collect relevant information.

Historical Evolution of Powerloom Industry

A powerloom is a mechanized loom powered by a line shaft, and was one of the key developments in the industrialization of weaving during the early industrial revolution. The first powerloom was designed in 1784 by Edmund Cartwright and first built in 1785, (https://en.wikipedia.org, accessed on 24/04/2017). This was remodelled by Kenworthy and Bullogh in 1787 and made its operation completely automatic. By 1850 there was 2, 60,000 powerlooms operating in England. Further, development of two types of powerloom with technological advancement took place with the introduction of Automatic pirn/shuttle changing loom and second with shuttle less loom (https://en.wikipedia.org). Western countries especially Britain and later US enjoyed supremacy in world textile and clothing trade for over two centuries but now the shift is taking place from West (US and EU countries) to East particularly China, India and Pakistan (GoI, 2016).

Types of Powerloom

Automatic Pirn/Shuttle Loom

By the end of 19th century, looms still had to be stopped every few minutes, as weavers needed to replace the empty weft pirn or cop. In 1895, Charles Roper introduced the essential stop-warp motion, which stoped the loom in the event of warp thread breakage. Shuttle loom with and without weft replenishment systems have been produced and improved. Further, shuttle looms are classified on the basis of mechanism as Tappet loom, Jacquard loom, Pile loom, Gauge loom, Drop Box loom, Dobby loom, Plain loom and Terry loom https//textinfo.wordpress.com, accessed on 25/05/2017).

Shuttle less looms

The shuttle less loom is also called modern loom. After 1945, productivity needed to be enhanced to accommodate rising labor costs particularly in the western world. It is totally automatic loom and productivity is much high. Johann Gabler is generally considered the father of shuttle less loom, which was patented later in Germany in 1925. The major revolution in this field was noticed in the seventh decade of twentieth century when electronic parts were introduced to control various operation of the loom and subsequently the solenoids and servomotors were used in the loom. The shuttle less looms can be classified based on weft insertion system as Projectile loom, Rapier loom, Air loom and Water loom.

Weaving Process

The first major advancement in weaving technology was introduction of loom driven with power (steam/electricity) which could produce cloth faster and of superior quality. Weaving is the systematic interlacing of two or more sets of elements usually, but not necessarily, at right angles, to form a coherent structure. Still it is not known when or where weaving process actually began, but as far back as there is a relic of civilized life. In weaving process the loom is manually thrown through the warp shed, after these threads are pressed together. The weaving process consists of five basic operations starting from shadding in which the warp yarns are separated into two layers by lifting and lowering the shafts, to form a tunnel known as the 'shed.' In picking or filling stage the weft yarn is passed across the warp threads through the shed which if followed by beating up or pushing the newly inserted weft yarn back into the fell using the read. The warp yarns are also unwound from the warp beam and the woven fabric is woned on the cloth beam during the above three processes.

History and Growth of Powerloom Industry in India

Powerloom industry is one of the oldest and largest industries in India. The East India Company established its office in 1601 in Calcutta and starting trading to Great Britain. India developed its

textiles sector and started exporting cloth to China, Afghanistan and to Central Asia. Trades of cloth started between Britain and India and continue to grow till middle of 18th century. After the invention of spinning and ginning machines, the Britishers discouraged promotion of cloth in India and only Indian raw cotton was exported to United Kingdom.

Pre-independence Period

The first attempt was made to start the textile mill in Calcutta by an Englishman named Bowroch in 1818, and in south India by Frank Harvey, in 1885 (Senthilkumar and Rajendran 2014). In 1854, four handloom textile units began operating. The first and second World Wars increased demand for Indian textile. The number of mills increased to 261 by 1911. Today textile industry can be classified into man-made fibers, cotton, silk, wool and jute. Tamil Nadu, Maharashtra and Gujarat account for bulk production of yarn (Senthilkumar and Rajendran, 2014).

Post-Independence Period

After 1950's, powerloom industry in India, occupied 5 percent, handloom 45 percent and mill sector 50 percent in cloth production. At present powerloom industry dominates as 60 percent of cloth production comes from powerloom industry and remaining from powerloom, hosiery and mill sector as cost of production is higher in the mill sector than in Powerloom industry (Senthilkumar and Rajendran, 2014). After 1991 rapid growth of powerloom industry took place due to impact liberalization.

Table 1: Powerloom industry in India, 2006-2016

Years	Powerlooms Installed (in no.)	Growth (in per cent)
2006-07	1990308	-
2007-08	2106370	5.83
2008-09	2205352	4.69
2009-10	2246474	1.86
2010-11	2282744	1.61
2011-12	2298377	0.68
2012-13	2347249	2.12
2013-14	2367591	0.86
2014-15	2447837	3.38
2015-16	2522477	3.04
Total	**22814782**	**2.58**

Source: CoI, 2016 Ministry of Textile, Annual Report, 2017-17

Growth of Powerloom Industry

The handloom sector is as old as the civilization itself, growth of powerlooms on a fairly large scale came last in textile industry. The industry is divided into mill sector and other unorganized sector. The unorganized sector occupies the major share in powerloom industry. Powerloom Inquiry Committee (1960) dates back powerloom industry in unorganized sector to 1904 (Pradeep, 2014).

The earliest powerloom was installation at Ichalkaranji now in Maharashtra state (one of the princely state). In the early thirties many entrepreneurs purchased looms discarded by the mill in Bombay and Ahmedabad and converted them into powerlooms. Many of the powerloom weaving clusters were concentrated in Bhiwandi, Malegaon, Surat. With the closure of textile mills in 1970s and serious labor turbulence and strike in 1980-81 in Mumbai the organize mill sector started closing down and powerloom industry came into existence with a big leap (table 1). Number of powerlooms installed in India during last 10 years was in millions but average growth was only 26.73 percent. Maximum growth with 5.83 percent was observed during 2007-08 because of high competitive global demand, cheap workforce, good environment, government support to encourage economic growth, whereas, lowest with 0.68 percent was in 2011-12 due to diminishing demand, weavers, high cost of yarn and irregular electric supply. Today government is promoting shuttle less powerloom for high quality and fast cloth production (GoI, 2016-17).

Table 2: Growth and production of cloth in powerlooms, India, 2006-2016

Years	Total Cloth Production		Cloth Production in Powerlooms	
	(in million.sq. metre)	(in per cent)	(in million.sq. metre)	(in per cent)
2006-07	53389	-	32879	-
2007-08	56025	04.93	34725	5.61
2008-09	54966	-01.89	33648	-03.10
2009-10	60333	09.71	36997	09.95
2010-11	62559	03.68	38015	02.75
2011-12	60453	-03.36	37445	-01.49
2012-13	62792	03.86	38038	01.58
2013-14	63500	01.12	36790	-03.28
2014-15	65276	02.79	37749	02.60
2015-16	65505	00.35	36984	-02.02

Source: GOI, Ministry of Textile, Annual Report (2014, 2015 and 2016)

Growth of Cloth Production

India produces different types of cloth production by powerloom during 2006-2016 in various sectors as described in table 2. The highest growth of total cloth production is observed in 2009-10 with 09.76 percent while lowest 0.35 percent is observed in 2015-16 due to sluggish global demand and decline in competitiveness in global export. The trend shows gradual decline in production from 2006-07 to 2008-09 and highest in 2009-10 with growth of 9.95 percent in last 10 years due to increasing demand in international market. Slight decline is observed in 2010-11 and lowest 01.49 percent due to low profit, high cost of yarns, instability in electricity, insufficient market etc. The highest total cloth production (65505 million.sq.m.) is observed in 2015-16 because of government inittations to promote shuttle less powerlooms. The traditional powerlooms and unskilled workforce is one of the many reasons for low cloth production (53389 million.sq.m.) in 2006-07. Whereas, highest cloth production on powerloom 38038 million.sq.m. is observed in 2012-13 and lowest 32879 million.sq.m. in 2006-07(GOI 2014, 2015, 2016) (table 2).

Distribution of Powerlooms and Workforce in India

Large numbers of power looms both organized and unorganized are unevenly distributed in semi-urban and semi-rural areas in India. About 60 percent are of unorganized powerloom are distributed in states like Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh Rajasthan, Madhya Pradesh etc. Most of the powerloom concentrated. State-wise distribution of registered powerloom units during last five year (2011-2016) shows highest growth of registered powerloom in Haryana with 19.10 percent because of increasing demand of cloth, development of infrastructure, high productivity from modernized loom etc. Tamil Nadu (18.92), Andhra Pradesh (18.00) and Madhya Pradesh (11.39) also have high growth rate, whereas, Dadra and Nagar Haveli evidenced negative growth rate with -116 percent mostly due to low wage. Many of the other states shows zero growth like Bihar, Goa, Gujarat, Himanchal Pradesh, Jammu and Kashmir, Odisha, Punjab, Rajasthan, Uttar Pradesh, Telangana, Delhi, Chandigarh and Pondicherry because the powerlooms are technologically obsolescence. Powerloom industry also provides large workforce mainly male workers in the age-group 15 to 50 years (table 3).

State-wise distribution of employment in India described in table 4 reveals that maximum employment of 32 lakhs in powerlooms is found in Maharashtra during 2015-16 and most of the workers are from other state like Uttar Pradesh, Bihar, Madhya Pradesh, and Andhra Pradesh. The highest growth rate in employment is observed in Haryana with 19.20 percent during the period 2011 to 2016 and the lowest is found in Dadra and Nagar Haveli with -116 percent during the period 2011-2016 (GOI, 2016).

Table 3: State-wise distribution of registered powerlooms in India, 2011-12 to 2015-16

States/ Union Territories	Units (in no.)					Growth (in per cent)
	2011-12	2012-13	2013-14	2014-15	2015-16	
Andhra Pradesh	45,402	45,432	46,044	53,411	55,375	18.00
Assam	2,726	2,738	2,738	2,738	2,738	00.43
Bihar	2,894	2,894	2,894	2,894	2,894	00.00
Goa	122	122	122	122	122	00.00
Gujarat	3,23,384	3,23,384	3,23,384	3,23,400	3,23,400	00.00
Haryana	9,933	12,293	12,293	12,293	12,293	19.19
Himachal Pradesh	1,461	1461	1461	1461	1461	00.00
Jammu and Kashmir	65	65	65	65	65	00.00
Karnataka	81,890	81,890	81,890	81,890	82,665	00.93
Kerala	2,804	2,804	2,804	2,804	2,804	00.00
Madhya Pradesh	1,18,217	1,24,853	1,26,679	1,33,425	1,33,425	11.39
Maharashtra	11,77,094	12,07,961	12,23,957	12,80,694	12,80,694	08.08
Orissa	3,321	3321	3321	3321	3321	00.00
Punjab	23620	23620	23620	23620	23620	00.00
Rajasthan	34,271	34,271	34,271	34,271	34,271	00.00
Tamil Nadu	3,96,279	4,05,344	4,00,687	4,43,983	4,88,767	18.92
Uttar Pradesh	65,993	65,993	65,993	65,993	65,993	00.00
West Bengal	5,965	6,195	6,195	6,195	6,195	03.71
Telangana	0	0	0	0	741	00.00
Delhi	1102	1102	1102	1102	1102	00.00
Chandigarh	42	42	42	42	42	00.00
Dadra, Nagar Haveli	962	962	962	444	444	-116.66
Pondicherry	830	1070	1070	830	830	00.00
Grand Total	**22,98,377**	**23,47,817**	**23,67,594**	**24,74,998**	**25,23,262**	**08.91**

Source: GoI, Office of the Textile Commissioner, 20111-12, 2015-16

Table 4 : State-wise distribution of employment in powerlooms in India, 2011-12 to 2015-16

States/ Union Territories	Number of Workers				
	2011-12	2012-13	2013-14	2014-15	2015-16
Andhra Pradesh	1,13,505	1,13,580	1,15,110	1,33,528	1,38,438
Assam	6,815	6,845	6,845	6,845	6,845
Bihar	7,235	7,235	7,235	7,235	7,235
Goa	305	305	305	305	305
Gujarat	8,08,460	8,08,460	8,08,460	8,08,500	8,08,500
Haryana	24,832	30,733	30,733	30,733	30,733
Himachal Pradesh	3,653	3,653	3,653	3,653	3,653
Jammu & Kashmir	163	163	163	163	163
Karnataka	2,04,724	2,04,725	2,04,725	2,04,725	2,06,663
Kerala	7,010	7,010	7,010	7,010	7,010
Madhya Pradesh	2,95,543	3,12,133	3,16,698	3,33,563	3,33,563
Maharashtra	29,42,735	30,19,903	30,59,893	32,01,735	32,01,735
Orissa	8,302	8,303	8,303	8,303	8,303
Punjab	59,050	59,050	59,050	59,050	59,050
Rajasthan	85,678	85,678	85,678	85,678	85,678
Tamil Nadu	9,90,698	10,13,360	10,16,718	11,09,958	12,21,918
Uttar Pradesh	1,64,981	1,64,983	1,64,983	1,64,983	1,64,983
West Bengal	14,913	15,488	15,488	15,488	15,488
Telangana	0	0	0	0	1853
Delhi	2,755	2,755	2,755	2,755	2,755
Chandigarh	105	105	105	105	105
Dadra, Nagar Haveli	2,405	2,405	2,405	1,110	1,110
Pondicherry	2,075	2,675	2,675	2,075	2,075
Grand Total	**57,45,942**	**58,69,547**	**59,18,990**	**61,87,500**	**63,08,161**

Source: Col. Office of the Textile Commissioner, 20111-12, 2015-16

Government Schemes and Programmes for Unorganized Powerloom Sector

Group Insurance Scheme (GIS) for Powerloom Workers

The Government of India launched group insurance scheme in 2003-04 and through office of the textile commissioner in collaboration with life insurance Corporation of India. Powerloom weavers/ workers are enrolled under the scheme for a period of one year which is renewed on year to year basis. Under the Group Insurance scheme, 72,681 powerloom workers have been insured for the period 1st April to 30th April 2016 (GoI, 2016).

Group Workshed Scheme (GWS)

The Government of India introduced Group Workshed Scheme for unorganized powerloom industry in 2003, under the 10th Five Year Plan. The scheme aims at setting powerloom parks with modern weaving machinery to enhance their competiveness in the global market and the same was subsequently modified. Ordinarily, minimum 4 weavers should from a group with 48 modern looms of single width or 24 wider width looms and per person minimum 4 looms will be allowed to be installed. Since inception, 194 projects have been approved till 2016 (GoI, 2016).

Integrated Scheme for Powerloom Industry Development (ISPSD)

In order to achieve the overall development of powerloom industry, government announced the Integrated Scheme for Powerloom Industry Development during 2007-2008 with two components i.e. marketing development programmes for powerloom industry (BSM and seminar/workshop) and exposure visit by powerloom weavers to the other clusters (GoI, 2016).

Pilot Scheme of in-situ Upgradation of Simple Powerlooms

The scheme aims to improve quality and productivity of the fabric being produced by upgrading their existing simple loom with certain additional attachments and enable them to face the competition in domestic and international markets. Its aims at covering 99,000 loom during 12th plan. The scheme is meant for small powerloom weavers (GoI, 2016).

Comprehensive Powerloom Cluster Development Scheme

The Comprehensive Powerloom Cluster Development Scheme was formulated in 2008-09 to develop powerloom mega clusters at Bhiwandi (Maharashtra) and Erode (Tamil Nadu) Ichalkaranji (Maharashtra), and Surat (Gujarat) respectively. The design of cluster is to create world-class infrastructure and to integrate the production chain in a manner that caters to the needs of local small and medium enterprises (SMEs) to boost production and export. The modified comprehensive powerloom cluster development scheme (CPCDS) was approved by the cabinet committee on

economic Affairs (CCEA) in 2013 for implementation during the 12th plan period assisting for mega cluster (GoI, 2016).

All India Powerloom Board (AIPB)

All India Powerloom Board (AIPB) was constituted as an advisory board in 1981 for development of powerlooms including measures to achieve better productivity, increase efficiency and improve welfare of workers (GoI, 2016).

Programme for Modernization

The National Textile Policy 2000 (NTP 2000), emphasis on adoption of appropriate technology in unorganized industry and envisage action for rapid modernization. The textile package, announced in the budget for 2001-02, included a major programme for modernization of the powerloom industry by the induction of 50,000 shuttle less looms and 2.5 lakh semi/automatic looms in the unorganized powerloom industry. Moreover, the "Vision 2010" aims at setting up of additional 90,000 shuttle less loom in the country (GoI, 2016).

Institutional Finance for Modernization in Powerloom Industry

The credit flow for the modernization of unorganized textile sector can be classified into long-term credit and short-term credit. Long term credit is to create fixed assets like land and building, plant and machinery, furniture and raw material, salaries, wages as short-term credit of working capital loan. For improvement of unorganized powerloom sector in India following are some of the important suggestions as given below:

1. ***Technological modernization:*** In India, most of traditional powerloom is producing poor quality output. The majority of powerloom owners are small weavers having 4 to 24 powerlooms. Due to small size they are unable to get the benefit of modernization and upgradation fund scheme of the industry. The Government of India should initiate conversion of plain powerlooms to semi-automatic so that weavers are benefitted.
2. ***Marketing complex:*** In India, marketing of the textile produce is one of the major problems of the weavers as they are exploited by agents. Therefore, the government should develop and encourage textile marketing complexes and create textile parks and powerloom cluster in states to control pricing policies.
3. ***Product diversification:*** Majority of the weavers are producing semi-finished grey fabrics which they sell out at lower price. These products should be diverted to dyed fabrics and home textiles to get more profit. The government should provide infrastructural facilities to develop the power processing unit in India.

4. ***Electricity:*** The government should ensure uninterrupted power supply to the powerloom industry. Considering the predominance of small powerloom weavers with weak capital and input capacity, the state government may also provide concessional power for small weavers.

5. ***Technical and entrepreneurial Training:*** The workers employed in powerloom industry are mostly untrained. Labor productivity can be further enhanced by providing textile education and training to powerloom workers at powerloom service centre, technical institutions and textile department through different training programmes especially for workers. Further to improve the level of managerial and administrative skills of the weavers there is a need to expand services at powerloom service centers in terms of capacity and infrastructural facilities.

6. ***Financial institution:*** Financial facilities on the guidelines of NABARD should be provided by institutions to facilitate textile sector and help the poor and marginalized weavers.

7. ***Role of state government:*** The state government can play by implementing textile policy for the development of powerloom co-operative societies in the state. These co-operative forms of organizations should be strengthened to promote powerloom industry.

8. ***Awareness of government programmes and schemes:*** There is need to create mechanism of awareness regarding the government schemes so that weavers can take benefits from these schemes.

9. ***Factory working condition:*** Emphasis should be given on issues like working condition in factory, availability of facilities, proper regulation for cleanliness, health and safety measures, compensation in accidental cases according to Factory Act 1948 and Maharashtra Factories Rules 1963 for the welfare of the powerloom workers.

10. ***Price:*** Government should provide support for weavers affected by fluctuating yarn prices and set up shuttle less looms for revival of the industry

Conclusion

The unorganized powerloom industry is the lifeline of Indian textile sector in terms of cloth production and employment. The number of powerlooms has increased to 25.74 lakh by 2016. The cloth production by powerloom industry has been approximately 3700 million sq. m. in 2015-16 which account more than 60 percent of the total cloth production in the country. However, its growth has been stunted by technological obsolescence, fragmented structure, low productivity and lowest quality products. Therefore, Government of India should mainly focus on technology upgradation, modernization of powerloom, optimum level of production, welfare scheme for workers

and enhancing marketing of powerloom products. Huge skilled and unskilled workforce also has tremendous potentiality for development of unorganized powerloom industry.

References

GoI, (2009) Annual Report (2008-2009), Ministry of Textile, Government of India, New Delhi

GoI,(2012) State-wise Registration of powerlooms and employment, Office of Textile Commissioner, Ministry of Textile, Mumbai, accessed on 28/07/2017 http://www.txcindia.gov.in/html/comp per cent20table per cent20pdf per cent202015-16/OTIS per cent2015- 16 per cent20pdf per cent20NEW/ T-156 per cent20STATE WISE per cent20REGISRATION per cent20OF per cent20POWERLOOMS per cent20AND per cent20EXPLOYMENT.p df

GoI, (2013) Annual Report (2008-2009), Ministry of Textile, Government of India, New Delhi

GoI, (2015) Compendium of Indian Textile Statistics (2014-15), Office of the Textile Commissioner Ministry of Textile, Mumbai, accessed on 25/05/2017, http://txcindia.gov.in/html/comp per cent20table per cent20pdf per cent202014-15/officialindiantextile2014- 15sub.htm

GoI, (2016) Compendium of Indian Textile Statistics (2015-16), Office of the Textile Commissioner Ministry of Textile, Mumbai, accessed on 28/07/2017 http://txcindia.gov.in/html/comp per cent20table per cent20pdf per cent202015-16/officialindiantextile2015-16sub.htm

GoI, (2016) Programme for Action Modernization, Office of Textile Commissioner, Ministry of Textile, Mumbai, accessed on 28/07/2017, http://www.txcindia.gov.in/html/publication per cent20new per cent20.htm

GoI, (2016) State-wise Registration of powerlooms and employment, Office of Textile Commissioner, Ministry of Textile, Mumbai, accessed on 28/07/2017 http://www.txcindia.gov.in/html/comp per cent20table per cent20pdf per cent202015-16/OTIS per cent2015-16 per cent20pdf per cent20NEW/T-156 per cent20STATE WISE per cent20REGISRATION per cent20OF per cent20POWERLOOMS per cent20AND per cent20EXPLOYMENT.p df

GoI, (2017) Annual Report (2016-2017), Ministry of Textile, Government of India, New Delhi

GoI, (2017) Handbook on powerloom industry, Office of Textile Commissioner, Ministry of Textile, Mumbai, accessed on 24/08/2017, http://txcindia.gov.in/html/PLcover.htm

GoI,(2017) Powerloom clusters of India, Office of textile commissioner, Ministry of textile, Mumbai, accessed on 19/04/2017, http://www.txcindia.gov.in/html/publication per cent20new per cent20.htm

Muthu, N., (2015) Performance of Decentralized Powerloom Sector in India, Asian Journal of Multidisciplinary Studies, Volume 3, Issue 3, p-1

Pradeep, G., (2014) Socio-economic condition of the powerloom workers of the Bhiwandi, Thane, International Multidisciplinary Research Journal, Volume 1, Issue 8, pp 4-5

Senthilkumar, M. and Rajendran, R., (2014) Socio-economic development powerloom owners in karur district, Tamil Nadu, International Journal of Scientific Research, Volume 5, Issue 12, pp 1-2

NGJI, An International Peer-Reviewed Journal
NGSI-BHU, ISSN: 0027-9374/2020/1739
Vol. 66, No. 2, June 2020

Livelihood sources of Gond Tribes: A study of village Mangalnaar, Bhairamgarh block, Chhattisgarh

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Abstract

India has the largest concentration of tribal population of the world with 8.6 per cent population (2011). Gond is the largest tribe in India and most of its concentration is in Madhya Pradesh, Maharashtra, Chhattisgarh, Odisha, Telangana and Jharkhand. As most of the population of Chhattisgarh are tribes (30.6 per cent, 2011), popularly called a tribal state. Gond tribes are mostly concentrated in the southern part of the Bastar region, in seven districts and village Mangalnaar comes under district Bijapur. The Gond tribes are known as Maria and Muriya in Bastar region. Majority of the population of Mangalnaar village are Gonds followed by Yadav. Some of the Gond families have got converted to Christian. The study is based on personal observations, interviews and collecting information about livelihood sources of Gond community, how much they collect and earn from it. Most of them are dependent on traditional sources of livelihood like forest and forest-based products.

Keywords: Gond Tribes, Forest products, Traditional livelihood

Introduction

Tribal constitute 8.6 per cent of India's total population, about 104 million people according to the 2011 census. There are some 573 communities recognized by the government as Scheduled Tribes and therefore eligible to receive special benefits and to compete for reserved seats in legislatures, jobs and academic institutions. Central Indian states have the country's largest tribal concentration, and, taken as a whole, roughly 75 per cent of the total tribal population live there (Panduranga 2014 & Singh 2019). Among the tribal populations of India, the Gonds stand out by their numbers, the vast expanse of their habitat, and their historical importance. The majority of Gonds are found today in the state of Chhattisgarh, Maharashtra and Madhya Pradesh. Their main concentrations are the Satpura Plateau, where the western type of Gondi is spoken, and the district of Mandla, where the Gonds have adopted the local dialect of Hindi. The former princely state of Bastar, now included in Madhya Pradesh, is the home of three important Gond groups, namely, the Muria, the Hill Marias, and the so-called Bisonhorn Marias. All of them speak Gondi

dialects. The etymological significance of the term Gond is derived from the Telegu connotation "*Kond*" meaning hill. Its roots go back to a pre-Dravidian arrival in south India around 2000 BC. Interestingly, however, the Gonds consider themselves to be later entrants into God's world through the penance of Shiva's son Karta Subal. They were descendants of Ravan (Halkare 2013 & Koreti 2015).

Chhattisgarh one of the tribal-state of India in which most of the tribe are concentrated in the northern and southern parts of the state. The tribes of Chhattisgarh are a unique race who mainly inhabits the dense forests of Bastar. More than 70 per cent of Bastar's population is composed of tribes who account for 26.76 per cent of Chhattisgarh's total tribal population. The three principal sub-castes of the aboriginal Gonds are the Dorla, Madia and Muria races. The Gonds dominate most of Chhattisgarh tribal population and primarily depend upon agriculture, forestry, cottage industries, hunting and fishing for their subsistence. Though traditionally Gonds are agriculturalists and some practice shifting cultivation even today other than collecting forest produces for their livelihood (Paltasingh, 2014). But with time, the social, economic and cultural life of the Gonds in Chhattisgarh has changed. It is very important in this context to know as to how and why these changes have taken places and whether these changes have led to any significant shift in the traditional livelihood sources of the Gond community. To investigate this issue an attempt has been made to acquire information concerning the economic life of the Gond community in Chhattisgarh. The focus of the present study is to understand the Gond tribe and their sources of livelihood particularly settled in Mangalnaar village of Bhairamgarh block in Bijapur district located in the south-west corner of Bastar region. As per Census 2011, the total area of the village is 949.66 hectares with 137 households and 597 persons (354 women and 243 males) 63.48 per cent (379 persons) of the total population are of scheduled tribe population and total literacy is 39.69 per cent (a total of 237 with 151 male and 228 females (Census of India 2011 & District Handbook 2011).

The study area

The Mangalnaar village is remotely located and badly affected by Naxals. In the past decades in fear and exploitation, the tribes have crossed over the Indrawati River and made their home in the Mangalnar village, about 1 km from National Highway in the south. It is accessible only by National Highway 30 running from Raipur to Jagdalpur and National Highway 63 from Jagdalpur to Bijapur. In 2005, the local tribes were given training and weapons against the Naxalites by the state government, called the '*Salwa Judum*' campaign. The word *Salwa Judum* is derived from the Gondi language meaning 'peace march'.

Data sources and methodology

The social and economic perspective of the tribes is considered for a better understanding of their present condition in the study area. Participant's observation regarding their socio-economic and cultural aspect is at close proximity through field observation, recording and photography. The help of secondary information is taken from sources such as documents, journals, books and newspapers. Further, information is also collected through primary investigation which involves personal observation, informal interviews, schedule and photography. Mangalnar being predominantly a tribal village, 96 percent of the total respondent are scheduled tribe and 4 percent belongs to other class. A well-structured interview schedule is distributed among the Gond community both from male and female of

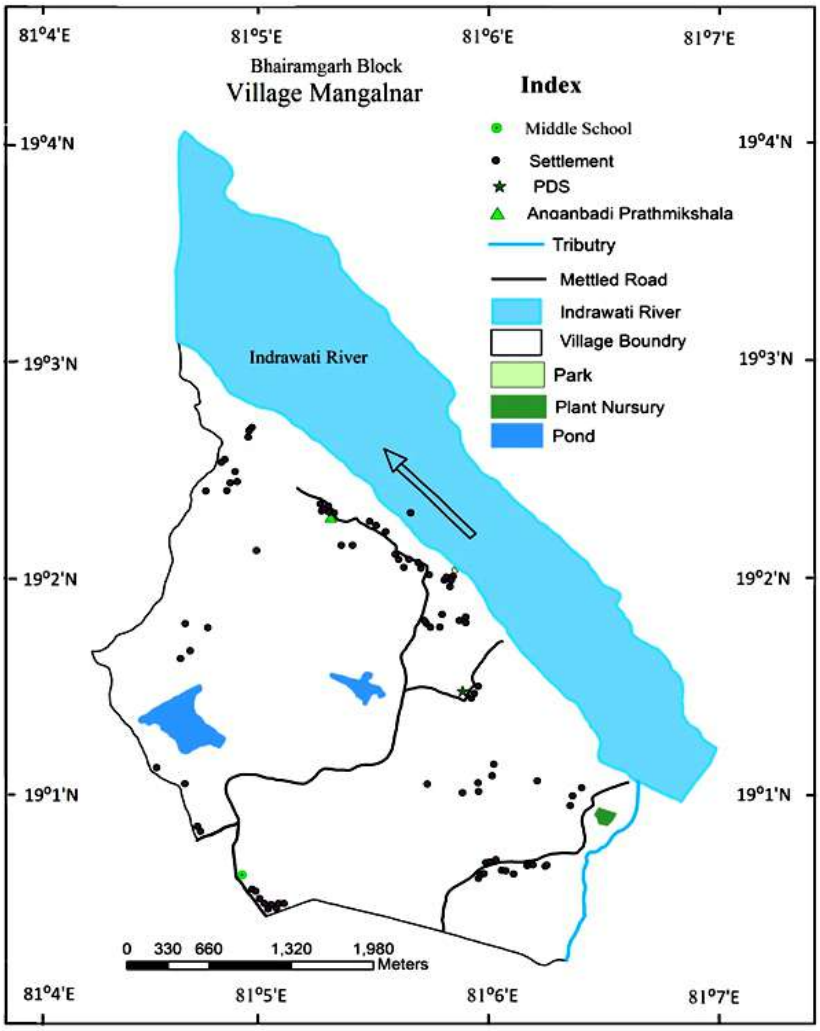


Figure 1: Location of the study area

different age groups.

For this 100 respondents are selected which is 16.75 percent of the total population (597 persons) of Mangalnaar village (Figure1). Out of the total respondent, 35 percent are in the age-group of 18 to 30 years, 49 percent are 30 to 60 years and 14 percent are above 60 years. About 95 percent of the households in this village that belong to Hinduism and 5 percent to Christianity. Further, 92 percent of the total interviewed are illiterate, while, 8 percent have only attained primary education. One of the key reasons for their illiteracy is Naxalite interference, lack of awareness, inaccessibility etc. However, today a good number of they are sending their children to school. Besides, 100 per cent of the respondent practice traditional sources of livelihood such as forestry, hunting and fishing. Men go for hunting and for collecting forest products or fishing the entire family participate. About 20 per cent of the respondents are casual labours who are

Table 1: Socioeconomic Status of Respondent

Category	Respondent	
Age-group	Total	Percentage
<18	00	00.00
18-30	35	35.00
30-60	49	49.00
>60	14	14.00
Total	100	100.00
Religion		
Hindu	95	95.00
Muslim	00	00.00
Christian	05	5.00
Other	00	00.00
Total	100	100.00
Educational level		
Illiterate	92	92.00
Primary (1st to 5th class in Anganwadi)	8	8.00
Middle	00	00.00
Secondary	00	00.00
Higher Secondary	00	00.00
Graduate & above	00	00.00
Total	100	100.00
Occupation (multiple answers)		
Hunting	100	100.0
Fishing	100	100.0
Forest based	100	100.0
Agriculture labour	00	00.00
Casual labour	20	20.00
Other	00	00.00
Total	100	100.00
Income-group		
<1000	79	79.00
1000-2000	16	16.00
2000-3000	00	00.00
3000-4000	00	00.00
>4000	05	05.00
Total	100	100.00
Landholding (in acre)		
Landless	34	34.00
1 to 5	60	60.00
5 to 10	6	6.00
Total	100	100.00
Social-group		
General	00	00.00
SC	00	00.00
OBC	04	4.00
ST	96	96.00
Total	100	100.00
Fuel used for cooking		
Fire wood	100	100.00
Dunk Cake	00	00.00
LPG	00	00.00
Total	100	100.00

Source: Field Survey, 2018

involved in construction work in and around Bhairamgarh town. This is generally after the rainy season when they are unable to collect the forest products and in the same condition when there is no forest cover. As they practice traditional source of livelihood or are casual workers the monthly income remains very low (ranging from less than Rs.1000 to more than Rs. 4000 only), moreover, 34 per cent of the Gond family are landless, 60 per cent owe 1 to 5 acres of land and 6 per cent have 5 to 10 acres of land (Table 1).

Livelihood sources of Gond tribe

Livelihood is defined as a set of economic activity, involving self-employment and wage employment by using one's endowment to generate adequate resources for meeting the requirement of the self and household on a sustainable basis with dignity. In everyday discourse, the term livelihood is referred to as how people make a living, access resources to sustain themselves and their families. Traditionally the linkage between the tribal community and forest is well established. Tribes are economically and ecologically inseparable from the forests. For their day-to-day requirement, be it food, fodder or fuel they are dependent on the surrounding forest for substance (table 2). Their dependence on the forest is such that they constitute the integral components of the forest ecosystem, forests have been the pivot on which tribal habitat and life revolves and has evolved so far; their religion-culture artefacts, belief system, cultural practices, technologies, and tools have been nurtured and cultivated under perennial plant associations and benign environment (Mishra 2012, Hasrat 2006 &Tumsare 2016).

Table 2: Forest produce and its use

Forest products	Procurement season	Uses
Mahua Flower	Mar-Jun	For brewing liquor
Chironji	April-May	As a *mewa* for *khir* and sweets
Tendu Patta	April-May	For Making *Bidi*
Tamarind Seed	April- June	For starch manufacture
Tora	May-July	Oil for soap manufacture and cattle feeding
Charota seed	Aug-Sep	For soap manufacture
Amchur	May-Jun	For condiments and *mashala*
Salfi	April-Jun	As a liquor

Source: Shristi_Products, http://www.banajata.org/pdf/case-studies/Chattisgarh.pdf

Shifting cultivation also known as *Jhum*, *Khallu*, *Podu* etc. is also in practice at small scale as govt. has banned shifting cultivation. About 1.6 per cent of the tribal people depend on shifting cultivation and 10-15 per cent depend on hunting for their livelihood (Mehta, 2000). The Gonds of Mangalnaar village are mostly dependent on traditional livelihood sources as observed in table 3. About 100 per cent of the respondent mentioned that they collect *tendu* patta, mahua flower, fishing, leafy vegetables, *tora*, *chironji* and *tendu* fruits from the nearby forest. Most of these forest products are consumed by the locals. As a result, children remain undernourished, suffer from malnutrition and the tribal community as a whole is forced to live in under poverty.

Forest: Forest is a major part of tribal life. They provide a source of livelihood among the community in the form of direct employment, self-employment and secondary employment. They collect flower of *mahua*, *tora*, *tendu patta*, *tendu* fruits, *salfi*, leaf plate, tamarind, honey and *lakh* from the forests.

Mahua: Mahua is a large deciduous tree with mahua flowers growing widely under dry

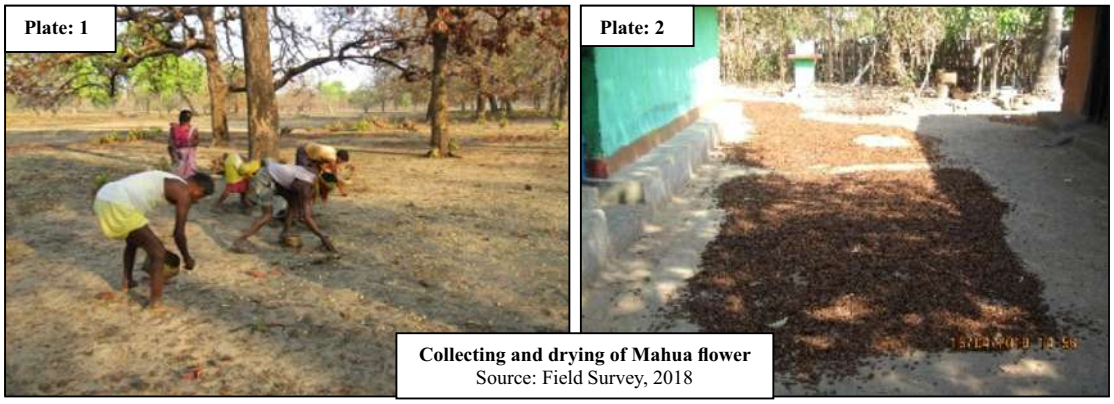
Table 3: Dependency of the tribe on forest and agricultural commodities

Forest commodities	Multiple responses	
	Respondents	Percentage
Tendu Patta	100	100
Mahua Flower	100	100
Salfi	92	92
Fish	100	100
Paddy	66	66
Kodo	24	24
Leafy vegetables	100	100
Tora	100	100
Chironji	100	100
Tamarind	76	76
Bhusa *Til*	32	32
Charota seed	78	78
Tamarind seed	76	76
Tendu Fruit	100	100

Source: Field Survey, 2018

tropical and sub-tropical climatic conditions. The tree has religious and aesthetic value in the tribal culture. The entire families including small children are involved in the collection of mahua flowers beginning from the first week of March.

After drying the flower its filaments are removed and kept warm in the sack with



Collecting and drying of Mahua flower
Source: Field Survey, 2018

appropriate moisture (Plate 1& 2). About 10 to 20 kg of Mahua is taken along for selling in the weekly market in Bhairamgarh. In exchange, the families purchase the goods of their daily needs. In the summer months, the Mahua is sold for Rs. 15 to 20 per Soli (approximately one-kilogram Mahua is a Soli) (Plate 1 & 2). The price varies according to the seasons with the highest cost (Rs.35 to 40 /Soli) in the rainy season. In return, the family earns around Rs. 400-500 per day. *Daru* or *Suram* is also prepared after processing the Mahua flowers which are also sold in the weekly market (Plate 3 & 4).

***Tendu Patta* and *Tendu* fruits**: Tendu Patta is called the green gold of the tribes because of its value. The tribes generally earn approximately Rs. 5000-6000 in a week which they use for storing food grains during the rainy season (June-September). It is one of the main sources of their livelihood. All family members earn an average of Rs. 5000-6000 per week during May which is sent to their account by the government. While Tendu fruit is ripened in March to April, the tribes sometimes use them as one-time food due to its delicious taste (Plate 5, 6, 7, 8 & 9).

Plate: 3

Processing of Mahua Flowers
Source: Field Survey, 2018

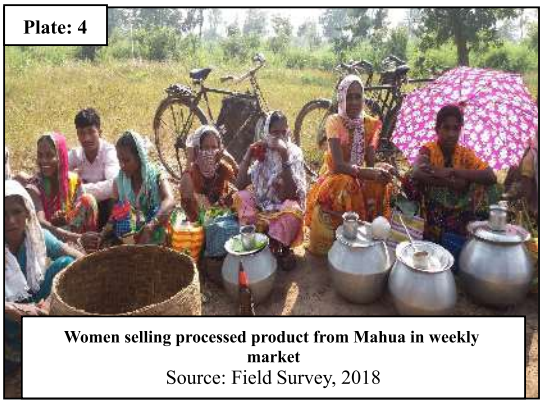


Plate: 4

Women selling processed product from Mahua in weekly market
Source: Field Survey, 2018

This money is then used on various occasions during the year. The Tendu fruits are also collected in March- April when the Tendu fruits start ripening. They are also used as cough medicines.

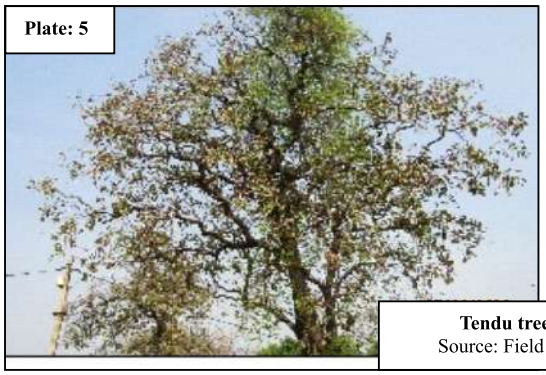


Plate: 5

Plate: 6

Tendu tree and fruit
Source: Field Survey, 2018

Leafy plate: The Gonds use the leaflets made by breaking the new leaves. The small

Plate: 7

Plate: 8

Plucking and bundling of Tendu patta
Source: Field Survey, 2018

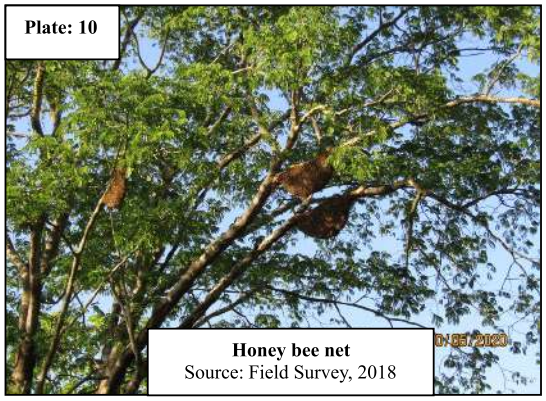
leaf is called the bowl (*chokni*) and big leaflet is called a plate. The indigenous bamboo thin sticks are used to give them a proper shape.

Plate: 9

Dry Tendu Leafy
Source: Fieldl Survey, 2018

Honey: The Gonds use it in medicine, eating and fulfilling certain traditional beliefs. Some Gonds also sell it. They are unaware of their value and importance (Plate 10).

Plate: 10

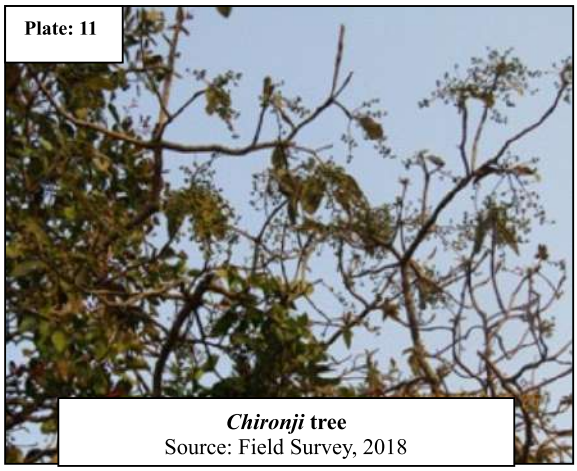


Honey bee net
Source: Field Survey, 2018

***Chironji*:** Is a type of dried fruit, which gets ripen during April-May. Though Gond tribes use it very little, they dry and sell it in the weekly market and get a good return from non-tribals (Plate 11).

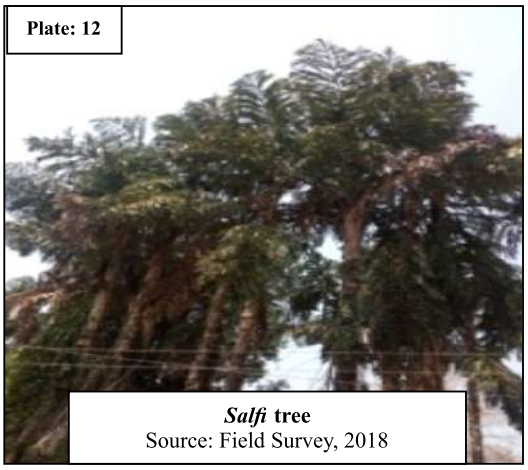
***Salfi*:** It is a species of palm plant from which beverages are extracted. It is also known as *Bastar Beer*. During April and May, the Gond tribes cut the top of the salfi tree to extract beverages. It can also be called local stomach medicine. Family members drink and women also sell in the weekly market (Plate 12).

Plate: 11



***Chironji* tree**
Source: Field Survey, 2018

Plate: 12



***Salfi* tree**
Source: Field Survey, 2018

Tamarind: The Gonds use the tamarind trees largely found in the village. The Tamarind tree produces pod-like fruit that contains an edible pulp used in cuisines, as traditional medicine and also for metal polish.

Agriculture: Other than forest and forest-based products the second major source of livelihood among the Gonds is agriculture. Only the paddy crop is grown. Sowing of the rain-fed paddy seeds is done by ploughing in the field and leaving it to germinate. They harvest the crop directly after they are mature and ripe with the help of family members. Other than sustaining their demand sometimes they also sell out in the nearby weekly market.

Culturally Gonds are deeply associated with paddy cropping. After every harvesting, they celebrate in which people visit each other's house, sing and dance and exchange new rice is grown (plate 13). Other than paddy Gond tribes traditionally use rice for making local beverage *Landa* and *Pej*. It is observed that out of the total respondent (100) only 66 of them mentioned that they owe land. Further, out of these 66, only 42 (63.63 per cent) stated that they practice single cropping of traditional paddy cultivation in their land, while, 36.36 per cent of them leave their land uncultivated (table 4).

The probable reasons for hindrance in cultivating land are undulating land, plateau soil, lack of irrigation facilities and dependency on monsoon rainfall in these regions.

Table 4: Type of land use

Type	Respondent	
	Number	Percentage
Cultivated	42	63.63
Uncultivated	24	36.36
Total	66	100.00

Source: Field Survey, 2018

Moreover, the use of Indrawati river water for irrigation is very negligible as reported (table 5)

Fishing: The Indrawati River flowing in the north is the lifeline of the tribes of Bastar in general and the Gond tribes of Mangalnaar village in particular. Indrawati is very close to the heart of the Gond community as they are dependent for their livelihood and rituals. Fishing is practised throughout the year. However, after every rainy season, the river water is mostly used for fishing. Dried fish or *Suksi* in the local language is eaten throughout the year. After the rainy season, they sell *Suksi* to the nearby weekly market and buy their essentials (Plate 14).

Table 5: Source of water for Irrigation

Type	Respondent	
	Number	Percentage
Pond/Well/Canals	00	00.00
River	00	00.00
Monsoon rainfall	100	100.00
Total	100	100.00

Source: Field Survey, 2018

Hunting: Though poaching is banned by the government it is not strictly followed in this tribal-dominated area. Involvement of Naxals also restricts vigilance by government agencies for controlling poaching. The Gond tribals hunt collectively but only to sustain their family and prefer not to sell it in the market. Though hunting is a major part of the life of the Gond tribes, it is not very popularly practised in Mangalnaar village because of its proximity and influence of the Nagar Panchayat. Though Gond families come together only the young members in small numbers go for hunting wild boar, bird and deer etc.

Significance of forest product for Gond tribes

Gond tribes depend on the forest for survival, from the wood, waterways, providing habitats to more than half of the world's land-based species and livelihoods for the people. It also provides shelter, medicines, water, food

and fuel. All these activities directly or indirectly involve forests. For livelihood, they sale of fuel, use wood and fodder, grazing, forest-based agriculture handicrafts and cottage industries, sericulture, lac cultivation, beekeeping, charcoal burning, leaf plate making, liquor making, rope making, basketry, medicines, food processing and marketing of non-timber forest products, cultivation of crops, under silvicultural practices, livestock rearing, social and farm forestry etc. After leafy vegetable, Tora (Mahua seed), Bhusa til, Charota seed, Amchur (Mango Powder), Tamarind seed, Tendu fruit are also collected and sold at a reasonable price by the tribes during the year (table 6).

Further, the respondents also informed that these forest products are purchased by the *kochiya* or the buyers of forest products in the weekly market (Friday market) and they do not

Table 6: Income generated from different commodities

Name of commodities	Approximate income (Rs./Year)
Tendu Patta	5000-6000
Mahua Flower	4000-5000
Salfi	3000-4000
Fish	3000-4000
Paddy (Traditional cultivation)	3000-4000
Kodo	2000-2500
Leafy vegetables	2000-2500
Tora	1000-1500
Chironji	600-1500
Tamarind	500-1500
Bhusa Til	500-1000
Charota seed	500-800
Amchur	500-700
Tamarind seed	500-600
Tendu Fru it	400-500

Source: Field Survey, 2018

pay a fair price to the poor and innocent tribes (table 7).

The *kochiya* is one who generally comes from other states for trade and has permanently settled down and exploit local people.

Table 7: Weekly market rate of different agricultural and forest products

Months/ products	Rate of products (Rs./kg)									
	___	Tora (Mahua seed)	Tamarind (Imli)	Tamarind seed	Paddy	*Chironji (char bija)	*Amchur	*Kodo (kosar)	*Bhusa til	*Charota
Jan.	35-40	-	-	-	10-12	-	-	25-28	-	-
Feb.	35-40	-	15-20	-	10-12	-	-	25-28	-	-
Mar.	15-20	-	15-20	-	10-15	30-40	30-40	25-28	25-30	10-15
April	15-20	-	20-25	10-12	10-15	30-40	50-60	25-28	25-30	15-20
May	20-25	-	20-25	10-12	10-15	40-50	70-80	25-28	35-40	15-20
June	25-30	13-15	20-25	10-12	10-15	50-70	50-60	25-28	35-40	-
July	25-30	15-20	20-25	-	10-12	70-100	-	25-28	-	-
Aug.	30-35	15-20	-	-	10-12	-	-	25-28	-	-
Sep.	30-35	15-20	-	-	10-12	-	-	25-28	-	-
Oct.	30-35	-	-	-	10-12	-	-	25-28	-	-
Nov.	30-35	-	-	-	10-12	-	-	25-28	-	-
Dec.	35-40	-	-	-	10-12	-	-	25-28	-	-

Source: Field Survey, 2018
Note: * *Other important products*

Conclusion

The Gonds are distinct tribal groups with their unique life, culture, traditions, style, customs, festivals and social environment. It is interesting to notice that the tribal culture among the Gond community has changed in Mangalnaar village in compare to the same tribal community in other parts. They are adopting settled cultivation, agricultural labourers, household industry etc. whereas, rate of practising shifting cultivation, hunting, fishing for their livelihood is low. Moreover, significant change is observed in Mangalnaar village due to its proximity to the urban centre. But still, Gond tribes rely on the forest as their means of livelihood in these regions. They are fed by the forest and forest produce. They have their indigenous expertise particularly in the field of medicine. If proper support and handholding facilities are given to these people they can preserve their tradition and culture and also contribute to the developmental process of the country. Although cultural changes among the Gond tribe's communities in Bhairamgarh block is significant but still slow, nevertheless the pace of improvement indicates that the cultural changes among them seem to be spreading across the tribal villages. The Gond tribes are now getting the benefits of the schemes run by the government.

References

Census of India, 2011, District Handbook Bijapur Chhattisgarh, Primary Census Abstract

Halkare, G. and Vahia, M.N., 2013, Aspect of Gond Astronomy, *Journal of Astronomical and Heritage*, Vol.16 (1), pp. 1-2.

Hasrat A. And Alicia Cristina G. B., 2006, Baiga and Gond Tribes in Chhattisgarh, India: Comparative study of

community behaviours in the development context, *Grassroots Occasional Papers*, Grassroot Institute, New Delhi 6. pp. 3-17.

Koreti, I., S., 2015, *Religion of the 'Gond' Tribes of Middle India, South Asia Culture, History and Heritage*, International Association for Asian Heritage (IAAH) and Centre for Asian Studies, University of Kelaniya, Sri Lanka. pp. 86-87

Mishra M., 2012, Health status and diseases in tribal-dominated villages of Central India, *Health and Population Perspectives and Issues*, Vol.35 (4), pp. 157-175.

Paltasingh T. and Paliwal G., 2014, Tribal Population in India: Regional Dimensions & Imperatives, *Journal of Regional Development and Planning*, Vol.3 (2), pp. 27-36.

Panduranga, R., Honnurswamy, N., 2014, Status of Scheduled Tribe in India, International *Journal of Social Science and Humanities Research*, Vol. 2(4), p. 1

Singh S. S. and Sharma A., 2019, A study of Composite Index: With special context to Gond tribe of central India, *Humanities & Social Sciences Reviews*, Vol.7 (6), pp. 1064-1076.

Tumsare V., 2016, Livelihood Transformations and Contemporary Livelihood Struggles of Gond Women, *Indian Journal of Dalit and Tribal Social Work*, Vol. 3(3), pp.1-30.

http://tribal.cg.gov.in/tribal-development-schemes [accessed on 11 June 2020]

http://www.banajata.org/pdf/case-studies/Chattisgarh.pdf [accessed on 10 June 2020]

http://wwf.panda.org/our_work/forests/importance_forests/ [accessed on 10 June 2020]

http://tribal.cg.gov.in/ [accessed on 11 June 2020]