Impact of Nigerian Textile Industry on Economy and Environment: a Review.

Bello, O.S[1]., *Inyinbor, A.A[2]., Dada, A.O[3]. and Oluyori, A.P[4].

1. Department of Pure and Applied Chemistry, Ladoke Akintola University of Technology, P. M. B, 4000, Ogbomoso, Oyo State. Nigeria.

2,3,4. Department of Physical Sciences, Landmark University, P.M.B 1001, Omu Aran, Kwara State. Nigeria.

adejumokebose@yahoo.com, inyinbor.adejumoke@landmarkuniversity.edu.ng

***Abstract*--** **Environmental pollution is one of the issues of serious concern in the developing countries such as Nigeria; industrial activities contribute to the growth of the economy but usually at the expense of the environment. Although the Nigerian textile industry has in the time past contributed positively to the economy of her country it is not without its negative environmental impact. This review article covers the impact of Nigerian textile industry on her economy as well as her environment and most importantly is the environmental protection effort of the last five years (2008-2012).**

***Index Term*--** **Dye, Environmental pollution, Environmental protection, Heavy metals, Textile industry.**

I. INTRODUCTION

Our immediate vicinity (environment) is usually affected by various anthropogenic activities, one of such is local and regional pollution. Industrial activities among other things are a major source of environmental pollution. Water ecosystem for example is majorly affected by various industrial activities such as mining, cement production, soap and detergent productions and textile manufacturing [62,69]. Developing and especially densely populated countries like Nigeria has most of its water bodies contaminated by industrial effluents as river water is considered means of industrial effluent disposal [39]. Textile industries use a lot of water in their various manufacturing stages (i.e scouring, bleaching, mercerizing, dyeing, printing and final finishing) and hence they generate a lot of waste water. Effluents released from these operations usually contain a significant amount of pollution load as hundreds of dyes and auxiliary chemical are used in the most complex stages of wet processes (i.e dyeing and printing) and this is usually discharged into water bodies half treated or untreated. These dyes and other allied chemicals contribute to major pollution loads of the receiving water bodies. The major constituents of effluent discharged by dye house is the colour, it is the first contaminant to be recognized in waste water and the presence of its very small amount in waste water is highly visible and undesirable [36]. Textile effluents have been found to contains a higher amount of metals especially chromium, copper, lead and cadmium as these metals are being widely used in the production of colour pigments of textile dyes [31]. Extensive studies have been carried out on textile effluent here in Nigeria, Investigations usually carried out on textile effluents span from physicochemical properties through heavy metals and to dye or colour content of the effluent. Heavy metals and dye have serious environmental concern, their effect on the environment they are being released to i.e the water body and also the plants grown around the river have also been extensively studied. This review article gives an overview of the environmental impact of effluents discharge from various textile industry in Nigeria and most importantly also is the environmental impact of these industries.

II. PHYSICOCHEMICAL PARAMETERS AND STUDIES ON HEAVY METALS

The quality of any water is defined by its chemical, physical and biological contents, hence maintaining a healthy aquatic ecosystem depends on the physico-chemical properties and biological diversity, this call for a regular monitoring of water bodies with required number of parameters [43,68]. The importance of the determination of physicochemical parameter of water, effluents or sediments cannot be over emphasized as these parameters affect the concentration of heavy metals with organic matter and pH being the most important parameters controlling the accumulation and the availability of these heavy metals [3]. Industrial activities have been identified as a major source of pollution for water ecosystems. The production of textile, cellulose and various chemicals is usually connected with synthetic dyes usage along side with other toxic metals and the discharge of their effluents could have a serious hazardous influence on the environment.

Yusuff and Sonibare [70], investigated effluents from five major textile industries in Kaduna , these effluent were tested for Colour intensity, chemical oxygen demand (COD), total suspended solid (TSS), NH_3, biological oxygen demand (BOD_5), and S^{2-} also metals such as Al, Mn, Zn ,Fe, Cu were also investigated. Al, Mn, Zn, Fe were found to be within limit while Cu was found to be above limit about three fold. Akan *et al*, [7] reported the investigations on samples collected from tanneries and textile industries from Kano industrial area, result shows that the concentrations of BOD, COD, DO, nitrate, nitrite, sulphate, phosphate, chloride and heavy metals were higher than the limits set by WHO for the discharged of tanneries and textile effluents into river. Asia *et al*, [17] also studied the physicochemical properties and investigated some selected heavy metals in three effluent samples collected from textile factories in Kaduna, results shows that the heavy metals investigated has higher concentration than the Federal environmental protection agency (FEPA) standards for effluent discharge, physicochemical properties result indicates that the effluents may not be able to undergo up to 50% substrate biodegradation, thus biological processes may not be feasible for the treatment of these effluents. Wastewater samples at the point of discharge into river Chalawa were collected and analyzed for metals such as Cr, Cu, Pb, Zn, Fe and Mn, the investigation was done for both wet and dry season and result shows that the discharge of Cr, Cu, Pb, and Zn into the river, for both seasons, exceeded the maximum permissible limit given by the Federal Environmental Protection Agency of Nigeria (FEPA) and WHO [24].

Challawa River in Kano has also been investigated for the impact of effluent from tanneries and textile industries on it chemical characteristics. The samples collected at some selected points along the river was investigated for parameters such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), Dissolved oxygen (DO) total dissolved solid (TDS), anions and trace element and the result indicate that all the investigated parameters were found to be higher than the WHO limits for the protection of fish and other aquatic life [8]. Awomeso *et al*, [19] studied a river receiving effluents from textile industry in Lagos, dissolved oxygen at the points closest to the point of effluent discharge were found to be zero signifying that stream was heavily polluted and may not likely support aquatic lives.

Effluents generated from a textile industry located in Oshodi, Lagos State has also been investigated for its characteristics and to test the effectiveness of their waste water treatment techniques. Physico-chemical parameter investigated include pH, temperature, total solid, total suspended solids, dissolved oxygen, chemical oxygen demand, oil and grease, chlorides, sulphide and certain heavy metals such as chromium, cadmium and lead. The range of the physioco-chemical parameter was reported as follows pH 7.12-12.99, temperature 28.33-64.00°C, total solids (TS) 2000-31800 mgL^{-1}, total suspended solids (TSS) 300 – 780 mgL^{-1}, dissolved oxygen (DO) N.D - 1.50 mgL^{-1}, chemical oxygen demand (COD) N.D – 350 mgL^{-1}, oil and grease 160 – 2370 mgL^{-1}, Chlorides 21 - 1064 mgL^{-1}, Sulphide 1060 – 1400 mgL^{-1}, Chromium (Cr) 0.09 - 0.67 mgL^{-1}, Cadmium (Cd) 0.04 - 0.31 mgL^{-1} and lead (Pd) N.D - 0.35 mgL^{-1}**.** The percentage removal was also reported in the following range: TS; 15.1 - 86.5%, TSS; 46.4 - 51.3%, oil and grease; 35.0 - 92.9%, chloride; 27.6 - 65.5%, sulphide; 18.5 - 24.3%, heavy metals (Cr, Cd and Pd); 2.9 - 86.6%, temperature; 27.9 - 55.7%, pH; 20.3 - 45.2%. Based on the results of their investigations, it was concluded that the wastewater treatment technique as practiced by the company is inadequate to remove all the pollution loads generated [51**].**

For good design of wastewater treatment plant, statistical characterization of wastewater is significant and thus the statistical characterization of textile mill's wastewaters in Northern part of Nigeria has been carried out [52]. Report says the study revealed that textile wastewaters is nutrient deficient, contain chloride, some heavy metal, high COD, BOD , very high colour, COD: TKN and COD : TP ratio. The results mean concentration for BOD, COD, pH, colour, TKN, TP, chloride, sulphate, cadmium, chromium and zinc was reported to be 1593.42 mg/l, 6477.57 mg/l, 9.79,230, 13.87mg/l, 7.79mg/l, 312.35 mg/l, 8.56 mg/l, 0.06mg/l, 0.01 mg/l and 1.25 mg/l respectively.

III. EFFECT OF TEXTILE EFFLUENT ON LIVING ORGANISMS IN THE ENVIRONMENT

The effect of effluents from textile industries on fish, plants and other aquatic organism in the exposed water has been studied at various levels. Studies have also been extended to the plants and vegetables grown in the vicinity exposed to effluents from textile industries. The levels of Lead (Pb), Cadmium (Cd) and Chromium (Cr) in the tissue of *Talinum triangulare*, an economic plant grown around a textile industry in Ikorudu area of Lagos State was studied. The level of these metals in soil from the industrial area and the plants grown on the soil were found to be higher than its non-industrial area counterparts. The results obtained further confirm the increased danger of growing vegetables around industries [11]. Heavy Metals and Anion Levels in Some Samples of Vegetable Grown Within the Vicinity of Challawa Industrial Area, Kano State has been studied, concentration of heavy metals which include, Cu, Zn, Co, Mn, Mg, Fe, Cr, Cd As, Ni and Pb, were determined and were found to be higher than the FAO, WHO/EU and FAO/WHO allowed limit. The concentrations of the anions were also higher than the permissible limit [9]. Adeogun and Chukwuka [2] also worked on the differential sensitivity of saggital otolith growth and somatic growth in *Oreochromis Niloticus* exposed to textile industry effluent, the effluent samples for this study they reported was collected from a textile company (Sunflag PLC) at Eric Moore, Lagos, Nigeria. Their result was subjected to statistical analysis and it shows that there was serious weight loss in the exposed fish as compared with the control fish.

Olusegun *et al*, [58] carried out studies on the comparison of cytogenotoxicity effects of "treated" industrial effluents discharge from textile and paint industries in Lagos metropolis *using A. cepa* root-tip assay. They reported that textile effluent was found to be 4.5 times more toxic than the paint effluent.

IV. THE ROLE OF TEXTILE INDUSTRY BEFORE ITS COLLAPSE

Although in the pre colonial Nigeria, various textile processes such as textile weaving, spinning and dyeing, ginning carding had been a well-established occupation [40]. In order to contribute directly to economic growth and national development, government after the independence emphasized the proper utilization of local raw materials and hence modern textile industries began to emerge in the northern part of Nigeria with the first being the Kaduna Textile Mill [60]. Manufacturing is an assured means for wealth creation and industrialization remains one of the catalysts for rapid growth and development of any economy be it developed, developing or under-developed. It is capable of increasing the pace of economic growth and ensuring swift structural transformation of the economy[66]. Interestingly, Nigerian textile industry was once a good support to her country economy: (1) it was rated third largest in Africa after Egypt and South Africa, with over 250 vibrant factories operating above 50 per cent capacity utilization [45]. (2) It was the single largest employer of labour after the government for a significant part of the history of the country, providing direct employment to about 350,000 persons outside millions of indirect jobs and employments [65]. (3) The government derives as much as N2 billion per annum from textile related taxes and levies. Therefore, anything that affected this industry touched the nerve of the country [4].

Most surprisingly, the same industry which was found a major player in the manufacturing, giving about 350,000 Nigerians job has been declining along with its workforce (1995: 100,000, 2004: 50,000) until it was down to 26 by the end of 2007 with only 30,000 workers. Reports have it that textile companies have ever since been closing down on a yearly basis [29]. Murtala (2011) [45] presented the textile industries crisis this way *"The predicament that bedeviled the Nigerian textile economy that earlier had considerable advantage in textile production, which manifested itself in the last three decades as a result of globalization, resulted in steady deepening economic crisis which has had adverse and far reaching consequences. This considerably affected the textile industry, wiped out labour and left behind an unsecured nation"*

The Nigeria manufacturing sector is generally experiencing a state of declination, the various advantages/economic impact of the textile industry makes it a subject to be well considered. Various reasons has been attributed to the collapse of Nigeria textile industries, some of these problems boils down to high cost of production in a highly competitive market. The acquisition, maintenance and replacement of machinery was all foreign exchange dependant, the Nigerian textile industries was more labour driven than automation and this has a serious implication on the competitiveness of the product. Fully automated system may have limitations in Nigeria where power, water and other basic amenities are epileptic. Inability of Nigerian government to manage her border successfully and the influence of western lifestyle on the people have led to the smuggling of both second hand and new clothes into the country. It has been reported that government loses about $400 million to smuggling annually, about $1.4 billion worth of textile materials floods the nations market annually and 85 percent of these is smuggled[46]. Above all is the insensitivity of the various administrations and over- dependence on oil revenue which has greatly contributed to the declining state of the Nigerian Textile Industry and her manufacturing sector as a whole [5].

Various efforts have been made to resuscitate the Nigerian textile industry and there is a national consensus that the textile industry must be revived [59]. It started with the Obasanjo led administration when an outright ban was placed on imports of textile materials into the Country. Although this did not work out effectively as a result of our porous border, evidence shows by the display of imported textile materials all over the country. The same administration took another step by setting up a committee, which initiated the textile intervention fund (#70-billion), with about 71% of this fund was to go to the textile and garment sector and about 29% was earmarked for cotton growers. The effort continues during late President Umaru Yar' Adua's regime, a hundred billion naira fund was earmarked to make cheap loans available to operators in the textile sector in order to bring them back to business. About ten billion of this fund was disbursed in January 2010. President Goodluck Jonathan continued in the same spirit and great success was recorded as Nigerian textile plc which suspended operations in October 2007 has resumed work with a workforce of 900 employees, the Vice President Namadi Sambo reopened the moribund United Nigerian Textile (UNTL) Plc under a special federal government intervention fund [4].

V. ENVIRONMENTAL PROTECTION

Environmental degradation which is "the deterioration of the environment through depletion of resources such as air, water, and soil, the destruction of ecosystems and the extinction of wildlife" has been a serious concern to environmentalist. Environmental degradation may assume the form of chemical and biological degradation, aerobic or anaerobic biotransformation and mineralization processes. This believe is certain that environmental degradation is a consequence of human negligence but in the real sense of it, it is the intentional individual or collective actions that has put economic gains as of utmost importance and as result fails to give the environment its due respect. Although Industrialization manifests itself in rising incomes and levels of material welfare with a reduction in shares of population below poverty lines in any country, these benefits is usually achieved at the expense of the environment [37]. Environmental protection activities can be seen as a hierarchy of practices arranged in order of preference with pollution prevention having the highest preference over other methods such as treatment, re-use and recycline. Treatment of industrial effluent can be considered a means of pollution prevention as Industrial effluents remains a source of direct input of pollutants into aquatic ecosystem. Since the enforcement of industrial pollution and hazardous waste disposal laws is least in countries such as ours, many industries lacks central waste treatment tank and hence discharge half treated effluent or untreated effluent into the environment [58]. The shortcomings as well as the economic aspect of the conventional effluent treatment method must be considered especially for developing countries such as

Nigeria. For instance, the high cost of synthetic resins used in ion exchange processes is not economically friendly [45]. As a result of deficiency of conventional methods due to economic consideration or inefficient operations, there is the need for further research into low-cost and efficient system for removing of problematic toxicant from industrial effluent before they are discharged into the environment.

Environmental protection is the major business of environmentalist and in the quest for economically friendly and effective way of effluent treatment, various preparations of biosorbent as well as activated carbons from locally and readily available biomass has been carried out. The application of such prepared material for their efficiency in both organic and inorganic pollutants uptake has also been investigated. Heavy metals are among the conservative pollutants that are not biodegradable or undergo other break down or degradation processes hence are permanent additions to the environment (water and soil). The efficiency of coconut fiber as a sorbent for the uptake of As (III), Hg (II) and Pb (II) ions has also been reported, it was reported that adsorption capacity was found to be highest for Pb (II) followed by Hg (II) and As (III). Chemical modification was reported to affect adsorption capacity [33]. The potential application of (Basella alba L.) a fast growing plant for the removal of lead (II) and chromium (III) ions from aqueous solutions has been investigated and reported. Various parameters such as pH, biomass dosage, agitation time; and initial metal concentration were studied and reported to have direct influence on the uptake of the metals by the biosorbent. The uptake of metal was reported to decrease with increase in biosorbent dose for the two metals and kinetic data fitted well to the pseudo-second-order mode [21]. The removal of Zn^{2+} from dilute aqueous solution using maize (Zea mays) wrapper as the biosorbent has been reported. kinetic and equilibrium behaviour of Zn^{2+} by varying parameters such as pH, contact time and initial metal ion concentration at 27ºC were studied. Result as reported says initial pH would play a vital role in the biosorption of the Zn^{2+} from solution, the uptake of Zn^{2+} was also reported to increase with time [22].

Iyagba and Opete [35] Studied the uptake of Chromium and Lead using Palm kernel shell and Palm kernel husk as adsorbent .Batch adsorption studies were carried out as a function of parameters such as pH, contact time and adsorbent dosage. Chromium and Lead removal was found to be pH dependent with the optimum pH for Chromium removal being 3 while that of Lead was 5 for both Activated carbon materials. Their result as reported shows that a large proportion of Chromium and lead were adsorbed at low concentration of the adsorbate in solution and, therefore indicates a good potential for the application of agricultural wastes for heavy metal removal. Olayinka *et al* [56] did a comparative study using coconut husk adsorbents (modified and unmodified) teak tree bark adsorbents (modified and unmodified) for the removal of Ni (II) and Cr (VI) ions from aqueous solution. There result as reported shows that modified and unmodified coconut husk is more efficient than modified and unmodified teak three bark respectively.

Synthetic industrial waste was used to study the adsorption of Cr(VI) and Ni(II) on chemically (NaOH and HCl) modified coconut husk and the result was compared with results obtained from unmodified coconut husk. Result as reported shows that acid modification increases sorption capacity while NaOH modified biomass uptake is the lowest for the two metal ions [57]. The efficiency of oil-palm fibre treated with thioglycolic acid has also been investigated, the removal efficiency of the metals was reported to be pH as well as ionic size dependent. Maximum absorptions was reported at pH = 6 as 83.6 (Fe^{2+}), 75.6 (Zn^{2+}) and 50.8% (Mg^{2+})[10]. The sorption of Zn^{2+} using modified and unmodified tiger nut shell was investigated by Nnabuk and steven, [48]. To ascertain the optimum condition for the adsorption of the sorbate from aqueous solution by these shells, the extent of adsorption with respect to contact time, initial metal ion concentration, particle size of the adsorbent were monitored. The extent of metal ions uptake was reported to decrease with increasing contact time but increased with increase in the initial metal ion concentration. The sorption capacity of Neem leaves to remove Cu^{2+}, Ni^{2+}, Zn^{2+} and Pb^{2+} has been investigated. They reported percent removal after 120 minutes contact time to be 76.8, 67.5, 58.4 and 41.45 for Cu^{2+}, Ni^{2+}, Zn^{2+} and Pb^{2+} ions respectively [50].

Modified and unmodified cocoa pod husk biomass has been investigated for the uptake of Cu^{2+}, Cd^{2+} and Pd^{2+} from their aqueous solutions. Result as reported says that the adsorption capacity for unmodified biomass was 97.6057mgg-1, 98.8860mgg-1 and 99.9454mgg-1 for Cu^{2+}, Cd^{2+} and Pb^{2+} respectively [63]. The efficiency of unmodified Rahia palm fruit endocarp for the sorption of Iron (III), Lead (II) and Cadmium (II) ions has been investigated, parameters such as initial ion concentrations, temperature and particle size were studied. It was reported that the rate of sorption was affected by particle size and temperature. Maximum percentage adsorption was reported to be 98.7% [20]. The suitability of Amaranthus hybridus (African spinach) stalk and Carica papaya (pawpaw) seed was tested for removal of Mn (II) and Pb (II) ions from aqueous solution. The amount of metal ions removed from solution was reported to depend on the metal ion-substrate contact time, ion concentration and ion type [25]. The uptake of Cd(II) ions from aqueous solutions using Cassia siamea biomass has been investigated and reported, the batch equilibrium studies were carried out with respect to parameters such as pH, initial metal concentration and contact time to determine the efficiency of biosorbent. Maximum adsorption capacity was reported to be 9.81 mg/g [6]. The sorption capacities of yam peels, sweet potato peels and cassava peels were investigated for the uptake of Cadmium (II) ion. The tuber peels show very high efficiency as it was reported that more than ninety–five per cent of initial concentration of Cadmium (II) ion in the aqueous solution was sorbed by each of the tuber peels[53]. The batch adsorption study of Pb(II) and Cu(II) ions from aqueous solution onto modified and unmodified Gmelina arborea leaves was investigated by Jimoh *et al*, [38] they reported that the acid modified adsorbed higher than the unmodified biomass.

Senilia senilus (anadara) and Thais coronata (grastropoda) biomass has also been investigated for their effectiveness in the uptake of Hg^{2+}, Pb^{2+}, and Cd^{2+} .Report has it that these biomass proved highly effective as removal efficiency increased as the initial concentration increased. The removal of Hg^{2+} was reported to be highest ranging from 98.00 – 99.97 % [61]. Ideriah *et al [*32] investigated the ability of the biomass of palm fruit fiber in removing Pb, Cu, Ni and Cr from aqueous solution. Parameters such as concentration, contact time and pH variations were investigated. The application of the biomass to waste water showed percentage removal of 73% Pb, 78% Cr, 82% Cu and 87% Ni. The sorption capacity of the biomass was reported to decrease with increasing concentration of metal ion but increased with decreasing pH and increasing contact time. Maize fibre activated with citric acid has been investigated for its potential in the removal of metal ion (Cd^{2+} and Pb^{2+}). The adsorption of the metal ions was reported to depend on parameters such as metal ion concentration, adsorbent dosage and contact time. According to the Langmuir fit, the maximum binding capacities of the metal ions were 4.93 and 4.88 mg g-1 for Cd^{2+} and Pb^{2+} ions, respectively. It was concluded that citric acid modified maize fibres can be used in simple water treatment unit for the removal of Cd^{2+} and Pb^{2+} ions [72]. Surface functionalized coconut coir dust was investigated for its efficiency in the removal of cationic dye malachite green from effluent. Adsorption studies was reported as a function of solution pH, contact time and initial dye concentration and adsorption data analysed using various isotherms models. The adsorption capacity was reported to decrease with increase in adsorbent dose. However the percentage removal of the adsorbate was reported to increase from 74.5 to 92.0% at adsorbent dosage of 1.0g and 4.0g respectively. 94.8% was reported as the maximum percentage adsorption of malachite green [75].

Porous carbons prepared from various agricultural waste has found divers application in the removal of both inorganic and organics toxicants. The uptake of lead (II) by activated carbon prepared from cow dung has been studied, parameters such as temperature, contact time, pH, adsorbent dosage and concentration of adsorbate were all monitored. Result as reported showed that the adsorption was pH, temperature, contact times, and adsorbate concentration dependent, but was partly dependent on the adsorbent dosage [26]. Activated carbon prepared from bamboo has been investigated for its potential to remove basic dye, the studies of various experimental parameters such as pH, adsorbent dosage, temperature and initial dye concentration was carried out. Higher solution pH was reported to favour the adsorption of basic dye, the adsorption of dye increased with increasing temperature of the solution, indicating the process to be endothermic and dye removal increased with increase in the initial concentration of the dye [49]. Aluyor and Oboh [15] prepared granular activated carbon from animal horns and compared its lead ion uptake with commercial granulated activated carbon (GAC), their result as reported validate that animal horns can be used effectively for the removal of lead ions.

Activated carbon prepared from treated oil palm fruit fibre has also been investigated for the removal of Pb^{2+} from aqueous solution. The adsorption capacity was reported to be highest (439.06mg/g) at the highest initial concentration (500mg/l) [23]. Okoye *et al* [54] investigated the efficiency of activated carbon produced from fluted pumpkin (Telfairia occidentalis) seed shell for the sorption of lead (II) ion from simulated wastewater. The amount of lead (II) ion adsorbed at equilibrium from a 200 mg/L solute concentration was reported to be 14.286 mg/g. Granular activated carbon prepared from groundnut hulls have been investigated for its efficiency in the removal of pesticides. The activated carbon which was separately activated using KOH, H_3PO_4 and $ZnCl_2$ was reported to give a percentage removal of over 98% by all the sorbent prepared [16]. Nwosu et al [73] prepared Active carbon from *Thevetia neriifolia* nutshell and its efficiency in the removal of Pb(II) and Cd(II) ions from used oil was investigated and reported. The prepared activated carbon was fully characterized and was reported that FT-IR revealed stretch vibrations of C = O in ketones and aldehydes in the range of 1700-1735 cm^{-1} and SEM micrograph revealed numerous pores and crevices all over the surface of the activated carbon, 822.2 mg g^{-1}, 0.113 cm^3 g^{-1} and 551 m^2 g^{-1} were obtained for iodine number, micropore volume and BET surface area, respectively. Sorption was carried at pH 4.8 and adsorption capacity for Pb (II) ion was reported to decrease with increase in temperature.

Carbons prepared from saw dust and rice husk at varying temperature and activated with NaOH has been investigated for its potential in the removal of acetic acid, Cadmium ions, Lead ions and Iodine, percentage yield of the activated carbon from the raw materials, iodine number and adsorption of heavy metals from aqueous solutions were all determined. In their findings they reported that rice husk has the highest yield of 48%, it was also concluded that lower carbonization temperature increase the adsorptive capacity of activated carbon obtained from rice husk while higher carbonization temperature favours adsorptive capacity of activated carbon from saw dust [30]. Lawal *et al* [42] prepared carbon from millet and sorghum straws and activated it with phosphoric acid for its potential removal of phenol from aqueous solution. The maximum adsorption capacities of the granular activated carbon from the cellulosic precursors were reported to be 80.36 and 82.34 mg/g of carbon from millet and sorghum straws respectively.

Carbon prepared from Sheanut shells and activated with H_3PO_4 and its efficiency in the removal of Agrochemical (Atrazine) was investigated, GCMS analysis was carried out to measure the target sorbate. It was reported that sorted waste could be a potential source of active filter for atrazine sorption [67]. In another investigation, poultry droppings activated with H_3PO_4 was used for the uptake of herbicide and up to 89.216% Atrazine removal was reported [34]. Activated carbon prepared from fluted pumpkin stem waste has been investigated for its potential in the removal of organic pollutant (phenol). The kinetic studies were carried out and reported that data favored pseudo second-order with regression value of 0.987. Thermodynamic parameters ΔH^o, ΔS^o, and ΔG^o were reported to be negative revealing exothermic nature of the sorption process [27]. In another investigation, Ekpete *et al* [28] reported the adsorption of chlorophenol by an agro-based activated carbon prepared from fluted pumpkin stem waste and compared its result to a commercial activated carbon. It was reported that the Elovich equation evaluation showed the sorption capacity obtained for chlorophenol on fluted activated carbon as 47.62 mg/g and chlorophenol for commercial activated carbon as 38.46 mg/g.

Carbon prepared from saw dust and activated with NaOH was applied to synthetic effluent containing methylene blue, high sorption capacity of 99.67% was reported by these researcher [64]. The adsorption capacity of adsorbent prepared from cow bones was investigated for the removal of lead and chromium from aqueous solution, effect of initial concentration and adsorption isotherms were studied. The maximum adsorption capacity was observed for lead (1.42) at 30^oC and 10 minutes, while that of chromium (2.49) was observed at 30^oC and 10 minutes [55]. Alade *et al*, [13] prepared activated carbon from flamboyant pod (FB) and milk bush kernel shell (MB) and its effectiveness in the removal of naphthalene from simulated wastewater was carried out, also the effect of variational initial concentrations was investigated. They reported that the removal efficiencies of MB were relatively lower than those obtained from FB.

The use of clay, termite mound, fly ash and other materials as low cost adsorbents for the removal of various pollutants has also been reported by various researchers. The use of waste tyre powder as an adsorbent has also been investigated activated and inactivated waste tyre powders were used for the uptake of Pb^{2+} and Cd^{2+} in their aqueous solution. The inactivated waste type was reported to be a better adsorbent for the removal of Pb^{2+} than activated tyre removed over 86.66% of Pb^{2+} from solution [18]. The adsorption of copper and lead ions from aqueous solutions using natural clay as adsorbent has also been investigated. Parameters such as effects of contact time, pH and initial metal ion concentration on the adsorption process were studied at a fixed temperature of 303 K. In their findings, they reported a greater adsorption affinity for Cu(II) than Pb(II) with the maximum adsorption capacities reported as 15.77 mg g^{-1} (0.248 mmol g^{-1}) and 11.49 mg g^{-1} (0.055 mmol g^{-1}) respectively at 303 K [47]. Deferrated kaolinite has also been used in the preparation of porous carbon adsorbent to avoid the common metal impurities usually associated with porous carbon adsorbents derived from agricultural residues. The structural and adsorption characteristics of the prepared adsorbent were investigated using Fourier transform infrared (FT-IR) spectroscopy and methylene blue adsorption. Their result shows increase in methylene blue uptake as the concentration of methylene blue increases [44]. The removal of para-nitrophenol from aqueous solution using fly ash has also been investigated, parameters such as contact time, pH and temperature were studied. The uptake level of paranitrophenol by the sorbent was reported to increase at higher pH values while adsorption was reported to increase at lower temperature [14]. Akpomie *et al*, [12] reported the use of Ehandiagu clay as an adsorbent for the removal of Pb(II) ions from aqueous solution. The result showed an increase in adsorption capacity with increase in initial metal ion concentration. Abdus-Salam and Itiola, [1] investigated the potential of termite mound for adsorption and removal of Pb(II) from aqueous solutions, the morphology and mineralogical composition of the sorbent was well studied. The maximum Pb (II) adsorption capacity of the mound reported to be 15.5 mg/g.

VI. CHALLENGES AND FUTURE PROSPECT

Some of the challenges as revealed by the reviewed literatures are as follows

- The Nigerian textile industry was more labour driven than automation and hence its inability to compete well with foreign textile.
- Industries with fully automated systems produce at very high cost because the acquisition, maintenance and replacement of machinery were all foreign exchange dependent. The running cost of the machinery was also a serious concern as energy poverty is a major problem in Nigeria.
- Porosity of Nigerian borders gives room to smuggling of foreign textile and greatly reduces the patronage of locally made fabrics.

Advancement from the present state will involve serious strategy and a state of absolute determination for a change. Nigeria before the 1970's was known for her agricultural activities as her main source of foreign exchange was based on agricultural product exports. Agricultural activities was neglected because of the oil price shocks of the 70's and percentage of total agricultural export seriously declined from about 43% to about 7% [71].

A shift of focus by Nigerians from the oil revenue back to agriculture and Industrialization coupled with technological innovation will go a long way to salvage the present situation. Basic amenities such as energy also need to be addressed as it is important that it should be provided at affordable prices. Energy facilitates the achievement of growth and development desired by any nation.

CONCLUSION

Since industrialization is a key tool in increasing the pace of economic growth and ensuring swift structural transformation of the economy, as we hope for complete resuscitation of our textile industry and springing up of other manufacturing companies, therefore needs arise for the applications of laboratory findings into industries. Studies such as the use of adsorbent in column experiments, treatments of binary or ternary effluents which are close to what is obtainable in the industry will possibly give a clear idea of the industrial relevance and effectiveness of these prepared biomaterials. In practice, a composite effluent from textile industries does not contain either of metal or dye alone but both along with other pollutants [70,74]. Studies focusing on competitive adsorption in dye-metal binary solution will further give good insight into the efficiency and behavior of sorbents.

REFERENCES

[1] Abdus-Salam, N. and Itiola, A. D. (2012) Potential application of termite mound for adsorption and removal of Pb(II) from aqueous solutions. *J Iran Chem Soc.* DOI 10.1007/s13738-011-0047-2.

[2] Adeogun A.O. and Chukwuka A.V (2010) Differential Sensitivity Of Saggital Otolith Growth And Somatic Growth In *Oreochromis Niloticus* Exposed To Textile Industry Effluent. *Life Science Journal* 7(2).

[3] Afshin Qishlaqi and Farid Moore (2007) Statistical Analysis of Accumulation and Sources of Heavy Metals Occurrence in Agricultural Soils of Khoshk River Banks, Shiraz, Iran; *American-Eurasian J. Agric. & Environ. Sci*., 2 (5): 565-573.

[4] Aguiyi, G., Ukaoha, K., Onyegbulam, L.A. and Nwankwo, O. (2011) The comatose Nigerian textile sector impact on food security and livelihoods. Published by National Association of Nigerian Traders (NANTS).

[5] Agusto & Co.(2011)Industry insight Research, credit ratings, credit risk management, quarterly review, Issue 02. 12pp.

[6] Ajaelu, C. J., Ibironke, O. L., Adedeji, V. and Olafisoye, O. (2011) Equilibrium and Kinetic Studies of the Biosorption of Heavy Metal (Cadmium) on *Cassia siamea* Bark. *American-Eurasian Journal of Scientific Research* 6 (3): 123-130.

[7] Akan, J.C., Ogugbuaja, V.O., Abdulrahman, F.I. and Ayodele, J.T. (2009) Pollutant levels in effluent samples from tanneries and textiles of kano industrial areas, Nigeria. *Global journal of pure and applied sciences*; 15(3):343-352.

[8] Akan, J.C., Abdulrahman, F.I., Ayodele, J.T. and Ogugbuaja, V.O. (2009) Impact of tannery and textile effluent on the chemical characteristics of Challawa River, Kano state, Nigeria. *EJEAFChe, 8 (10):*1008-1032.

[9] Akan, J.C. F.I. Abdulrahman, V.O. Ogugbuaja and J.T. Ayodele (2009) Heavy Metals and Anion Levels in Some Samples of Vegetable Grown Within the Vicinity of Challawa Industrial Area, Kano State, Nigeria. *American Journal of Applied Sciences* 6 (3): 534-542.

[10] Akaninwor, J. O., Wegwu, M. O. and Iba, I. U. (2007) Removal of iron, zinc and magnesium from polluted water samples using thioglycolic modified oil-palm Fibre. *African Journal of Biochemistry Research*; 1 (2):011-013.

[11] Akinola, M.O., Njoku, K.L. and Ekeifo, B.E. (2008) Determination of Lead, Cadmium and Chromium in the Tissue of an Economically Important Plant Grown Around a Textile Industry at Ibeshe, Ikorodu Area of Lagos State, Nigeria. *Advances in Environmental Biology*, 2(1): 25-30.

[12] Akpomie, G.K., Ogbu, I.C., Osunkunle, A.A., Abuh, M.A. and Abonyi, M.N. (2012) Equilibrium Isotherm Studies on the Sorption of Pb(II) from Solution by Ehandiagu Clay. *Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS)* 3 (2): 354-358.

[13] Alade, A.O., Amuda, O.S., Afolabi, T.J. and Okoya, A.A. (2012) Adsorption of naphthalene onto activated carbons derived from milk bush kernel shell and flamboyant pod. *Journal of Environmental Chemistry and Ecotoxicology*; 4(7):124-132.

[14] Alinnor I. J. and Nwachukwu M. A. (2011) A study on removal characteristics of para-nitrophenol from aqueous solution by fly ash. *Journal of Environmental Chemistry and Ecotoxicology*; 3(2):32-36.

[15] Aluyor, E.O. and Oboh, I.O. (2009) Sorption of lead (ii) ions by granular activated carbon from animal horns: A comparative study. *Journal of Engineering and Technology Research;*1 (3):046-049.

[16] Aminu, A.S., Gimba, C.E., Kagbu, J., Turoti, M.., Itodo, A.U. and Sariyya, A.I. (2010) Sorption Efficiency Study of Pesticide Adsorption on Granulated Activated Carbon from Groundnut Shell Using GC/MS. *World Rural Observations*;2(1):18-24.

[17] Asia, I.O., Ndubuisi, O.L. and Odia, A. (2009). Studies on the pollution potential of waste water from textile processing factories in Kaduna, Nigeria. *Journal of toxicology and enviromental health science*; 1 (2):034-037.

[18] Asiagwu, A.K. Okoye, P.A.C., Orji, I. and Omuku, P.E. (2009) Sorption Potentials of Waste Tyre for Some Heavy Metals (Pb Cd) in Aqueous Solution. *Leonardo Journal of Sciences* Issue 14:227-234.

[19] Awomeso, J.A., Taiwo, A.M., Gbadebo, A.M. and Adenowo, J.A. (2010) Studies on the pollution of waterbody by textile industry effluents in Lagos, Nigeria. *Journal of Applied Sciences in Environmental Sanitation, V (N): 331-337*.

[20] Babalola, J.O., Babarinde, N.A.A., Oninla, V.O. and Popoola, O.A. (2008) Kinetics, Equilibrium, and Thermodynamics Studies of the Biosorption of Lead(II) and Chromium(III) by *Basella alba* L. *The Pacific Journal of Science and Technology* ; 9(2):610-620.

[21] Babarinde, N. A. A., Babalola, J. O., and Adebisi, B.O. (2008) Kinetic, isotherm and thermodynamic studies of the biosorption of zinc (II) from solution by maize wrapper. *International Journal of Physical Sciences*; 3 (2):050-055.

[22] Bello, O.S., Oladipo, M.A. and Olatunde, A.M. (2010) Sorption studies of lead ions onto activated carbon produced from oil-palm fruit fibre. *Stem Cell*;1(1):14-30.

[23] Dan'Azumi,S. and Bichi, M.H (2010). Industrial pollution and heavy metals profile of Challawa River in Kano, Nigeria. *Journal of Applied Sciences in Environmental Sanitation, 5 (1): 23-29*.

[24] Egila, J. N. , Dauda, B. E. N., Iyaka, Y. A. and Jimoh, T. (2011)Agricultural waste as a low cost adsorbent for heavy metal removal from wastewater. *International Journal of the Physical Sciences*; 6(8):2152-2157.

[25] Elaigwu, S.E., Usman, L.A., Awolola, G.V., Adebayo, G.B. and Ajayi, R.M.K. (2009) Adsorption of Pb(II) from Aqueous Solution by Activated Carbon Prepared from Cow Dung: *Adv. in Nat. Appl. Sci., 3(3): 442-446*.

[26] Ekpete, A.O. and Horsfall, M. Jnr (2011) Kinetic sorption study of phenol onto activated carbon derived from fluted pumpkin stem waste (*Telfairia occidentalis Hook*. F). ARPN *Journal of Engineering and Applied Sciences;* 6 (6):43-49.

[27] *Ekpete, A.O., Horsfall, M.* and *Tarawou, T. (2011)* Adsorption of Chlorophenol from Aqueous Solution on Fluted and Commercial Activated Carbon. *J. Nepal Chem. Soc*., 27: 1-10.

[28] Gado, N.D. and Nmadu, T.M. (2011) The Performance of Textile Companies in the North West Zone of Nigeria: the Role of Infrastructure as a Resource. *International Journal of Human Resource Studies***;** 2(1):89-100.

[29] Goodhead, T .O. and Dagde, K. K. (2011)Adsorption of Acetic Acid, Cadmium ions, Lead ions and Iodine Using Activated Carbon from Waste Wood and Rice Husks. *J. Appl. Sci. Environ. Manage;*15(2):407 – 410.

[30] Halimoon, N. and Yin, R.G.S. (2010) Removal of Heavy Metals from Textile Wastewater using Zeolite. *Environment Asia* 3(special issue) (2010) 124-130.

[31] Ideriah, T. J. K., David, O. D. and Ogbonna, D. N. (2012) Removal of heavy metal ions in aqueous solutions using palm fruit fibre as adsorbent. *Journal of Environmental Chemistry and Ecotoxicology;* 4(4):82-90.

[32] *Igwe, J.C., Abia, A.A. and Ibeh, C.A. (2008)* Adsorption kinetics and intraparticulate diffusivities of Hg, As and Pb ions on unmodified and thiolated coconut fiber. *Int. J. Environ. Sci. Tech*; 5 (1):83-92.

[33] Itodo, A.U., Abdulrahman, F.W., Hassan, L.G., Atiku, F.A. and Itodo, H.U. (2011) GCMS prediction of organochlorine herbicide sorption rate: A batch kinetic studies. *Trends in applied science research*, ISSN 1819-3579/DOI:10.3923/tasr.

[34] Iyagba, E.T. and Opete, O.S.E. (2009) Removal of chromium and lead from drill cuttings using activated palm kernel shell and husk. *African Journal of Environmental Science and Technology*; 3 (7):171- 179.

[35] Jaikumar, V. and V Ramamurthi (2009) Effect of biosorption parameters kinetic isotherm and thermodynamics for acid green dye biosorption from aqeous solution by brewery waste. *International Journal of chemistry*;1(1):2-12.

[36] Jamaluddin, Md. J., Kadaruddin, A., Kadir, A. and Azahan, A.(2009) Development, environmental degradation and

environmental management in Malaysia. *European Journal of Social Sciences*; 9(2):257-264.

[37] Jimoh, O. T. Muriana, M. and Izuelumba, B. (2011)Sorption of Lead (II) and Copper (II) ions from Aqueous Solution by Acid Modified and Unmodified Gmelina Arborea (Verbenaceae) Leaves. *Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS)* 2(5):734-740.

[38] Kanu, Ijeoma and Achi, o.k. (2011) Industrial effluents and their impact on water quality of receiving rivers in Nigeria. *Journal of Applied Technology in Environmental Sanitation*; 1 (1):75-86.

[39] Kayode, J.O. (2010) Technology Development in Nigeria:The Nigerian Machine Tools Industry Experience. *J Economics;* 1(2): 85-90.

[40] Lalitagauri Ray, Subham Paul, Debabrata Bera, and Parimal Chattopadhyay (2005), Bioaccumulation of Pb(II) from aqueous solutions by Bacillus Cereus $M^1{}_{16}$. *Journal for Hazardous Substance Research* (4): 5-21.

[41] Lawal, A.O., Lori, J.A. and Tuker, D.T. (2011) Removal of Phenol from Water by Carbon Adsorbents Prepared by Pyrolysis of Sorghum and Millet Straws in Ortho Phosphoric Acid. *Research Journal of Environmental and Earth Sciences* 3(4):429-432.

[42] *Lawson, E.O. (2011)* Physico-Chemical Parameters and Heavy Metal Contents of Water from the Mangrove Swamps of Lagos Lagoon, Lagos, Nigeria; *Advances in Biological Research* 5 (1): 08-21.

[43] Lori, J.A., Myina, O.M., Ekanem, E.J. and Lawal, A.O. (2011) Structural and Adsorption Characteristics of Carbon Adsorbent Synthesized from Polyfurfuryl Alcohol with Kaolinite Template. *Research Journal of Applied Sciences, Engineering and Technology*; 3(5): 440-446.

[44] Murtala Muhammad (2011a) Globalization crisis and national security: A reflection on Nigeria textile industry. *JORIND*; 9(1):88-95.

[45] Murtala Muhammad (2011b) Kano Textile Industry and the globalization crisis *JORIND* 9 (1) 363-368.

[46] Njoku, V.O., Oguzie, E.E., Obi, C., Bello, O.S. and Ayuk, A.A. (2011) Adsorption of Copper(II) and Lead(II) from Aqueous Solutions onto a Nigerian Natural Clay. *Australian Journal of Basic and Applied Sciences*, 5(5):346-353.

[47] Nnabuk O. E. and Stevens A.O. (2009)Modelling of the adsorption of Zn^{2+} from aqueous solution by modified and unmodified tiger nut shell. *African Journal of Pure and Applied Chemistry;* 3 (8):145-151.

[48] Nwabanne, J.T. and Mordi, M. I. (2009) Equilibrium uptake and sorption dynamics for the removal of a basic dye using bamboo. *African Journal of Biotechnology*; 8 (8):1555-1559.

[49] Oboh, I., Aluyor, E. and Audu, T. (2009) Biosorption of Heavy Metal Ions from Aqueous Solutions Using a Biomaterial. *Leonardo Journal of Sciences;* 14:58-65.

[50] Odoemelam, S.A., Iroh, C.U. and Igwe, J.C. (2011) Copper (II), Cadmium (II) and Lead (II) adsorption kinetics from aqueous metal solutions using chemically modified and unmodified cocoa pod husk (*theobroma cacao*) waste biomass; *Research Journal of applied Science* 6(1):44-52.

[51] Ogunlaja, O.O. and Ogunlaja, A. (2009) Evaluating the efficiency of a textile wastewater treatment plant located in Oshodi, Lagos; *African Journal of Pure and Applied Chemistry* 3(9):189-196.

[52] Oke, I.A., Okuofu, C. A. and Otun, J.A. (2006) A Statistical Classification of Textile Wastewaters in Northern Nigeria. *Journal of Applied Sciences Research* 2(4): 209-216.

[53] Okoro, I. A. and Abii, T. (2011) Sorption models Of Cadmium (II) ion onto agricultural tuber wastes. Am. J. Sci. Ind. Res., 2(3): 381-385

[54] *Okoye, A. I., Ejikeme, P. M. and Onukwuli, O. D. (2010)* Lead removal from wastewater using fluted pumpkin seed shell activated carbon: Adsorption modeling and kinetics. *Int. J. Environ. Sci. Tech*., 7 (4):793-800.

[55] Olaniyi, I., Moses, S. and Raphael, O. (2012) Adsorption study of Cr (VI) and Pb (II) from aqueous solution using animal charcoal derived from cow bone. *Der Chemica Sinica*; 3(3):648-657.

[56] Olayinka, K.O., Adetunde, O.T. and Oyeyiola, O. A. (2009) Comparative analysis of the efficiencies of two low cost adsorbents in the removal of Cr(VI) and Ni(II) from aqueous solution. *African Journal of Environmental Science and Technology;* 3 (11):360-369.

[57] Olayinka, O.K., Oyedeji, O. A . and Oyeyiola, O. A. (2009) Removal of chromium and nickel ions from aqueous solution by adsorption on modified coconut husk. *African Journal of Environmental Science and Technology;* 3 (10):286-293.

[58] Olusegun B. S., Fidelia I. O. and Peter G. C. Odeigah (2010) Cytogenotoxicity evaluation of two industrial effluents using *Allium cepa* assay. *African Journal of Environmental Science and Technology*; 4(1):021-027.

[59] Olutayo, A.O. and Akanle, O. (2009) *Aso-oke* (Yoruba's hand woven textiles) usage among the youths in Lagos, Southwestern Nigeria. *International Journal of Sociology and Anthropology;* 1(3):062-069.

[60] Onyenekenwa, C.E. (2011) Managing Nigeria's environment: The unresolved issues. *Journal of Environmental Science and Technology*; 4(3):250-263.

[61] Osu, C. I. and Odoemelam, S.A. (2012) Adsorption isotherm studies of Hg(II), Pb(II), and Cd(II) ions removal from aqueous solutions using unmodified and ester modified (esterified) *senilia senilus* and *thais coronata* biomass, *Journal of Applied Technology in Environmental Sanitation;* 2 (2): 77-86.

[62] Osuntogun, A., Edordu, C.C. and Oramah, B.O. Potentials for diversifying Nigeria's non-oil exports to non-traditional markets; AERC Research Paper 68 (1997) 44pp.

[63] Panda Unmesh Chandra, Rath Prasanta, Sahu Kali Charan, Majumdar Sabyasachi, Sundaray Sanjay K (2006) Environmental quantification of heavy metals in the Subrarnarekha, estuary and near-shore environment, east coast of India. *Asian J Water Env Polln,* 3(2):85-92.

[64] Samuel, E. A. and Ayobami O. A. (2011) Evaluation of Microbial Systems for Biotreatment of Textile Waste Effluents in Nigeria: Biodecolourization and Biodegradation of textile Dye. *J. Appl. Sci. Environ. Manage*; 15(1) :79 – 86.

[65] Suleiman, I., Muhammed, M. N., Yahaya, A. I. and Etsuyankpa, B. M. (2012) Sawdust as an Adsorbent for the Removal of Methylene Blue from Aqueous Solution: Adsorption and Equilibrium Studies. *Journal of Chemical Engineering;* 1(1):11-24.

[66] Teresa Mwuese Nmadu (2008)Trade and Declining Worker Rights In Nigeria's Textile Industry: 1997-2006. Published by the Forum on Public Policy.

[67] Udoh, E. and Udeaja, E.A. (2011) Ten Years of Industrial Policies under Democratic Governance in Nigeria: "New Wine in Old Bottle"*European Journal of Social Sciences ;20(2):248-258.*

[68] Udoji, I.A., Abdulrahman, F.W., Hassan, L.G., .Maigandi, S.A. and Itodo, H.U. (2010)GC/MS Batch Equilibrium study and Adsorption Isotherms of Atrazine Sorption by Activated H3PO4 - Treated Biomass. *Journal of American Science*; 6(7):19-29.

[69] Venkatesharaju K., Ravikumar. P., Somashekar. R. K., Prakash. K. L. (2010) Physico-chemical and bacteriological investigation on the river cauvery of kollegal stretch in Karnataka. Kathmandu University. *Journal of Science, Engineering and Technology*; 6(I):50-59.

[70] Yemendzhiev, H., Alexieva, Z. and Krastanov, A. (2009)., Decolorization of synthetic dye reactive blue 4 by mycelial culture of white-rot fungi *trametes versicolor* 1. *Biotechnol. & Biotechnol.* 23(3):1337-1339.

[71] Yusuff, R.O. and Sonibare, J.A. (2004) Characterization of textile industries' effluents in Kaduna, Nigeria and pollution implications. *Global Nest: the Int. J.*;6(3): 212-221.

[72] Tyowua, A.T., Okieimen, F.E. and Ojeigbe, O.J. (2013) Equilibrium and Kinetic Studies of Adsorption of Cd^{2+} and Pb^{2+} Ions from Aqueous Solution by Citric Acid Modified Maize Fibres; Chemical Sciences Journal :CSJ (93): 1-10.

[73] Nwosu, F.O, Olu-Owolabi, B.I. and Adebowale, K.O. (2012) Kinetics and Thermodynamic Adsorption of Pb(II) and Cd(II) Ions from Used Oil onto *Thevetia neriifolia* Nutshell Active Carbon. *Current Research in Chemistry, 4: 26-40.*

[74] Sathiya, M.P., Periyar, S.S., Sasikalaveni,A., Murugesan, K., and Kalaichelvan,P.T. (2007)., Decolorization of textile dyes and their effluents using white rot fungi. *African Journal of Biotechnology* **6**(4):424-429.
[75] Etim, U.J., Inam, E., Umoren, S.A. and Eduok, U.M. (2013) Dye Removal from Aqueous Solution Using Coconut Coir Dust Extract-modified Polyvinyl alcohol: A Novel Adsorbent; International Journal of Environment and Bioenergy; 5(2): 62-79.