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The Effect Of Different Aqueous Environments On The Modified Cellulose Pulps As Crude Oil Absorbent

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ABSTRACT

The influence of different aqueous environment: fresh water and sea water media on the absorptive capacities of modified cellulose pulps as crude oil absorbent was studied. The results showed that increased crude oil spills at constant modified cellulose absorbent weight deceases the amount of crude oil absorbed significantly. The salty environment marked by the sea water medium has significant effect on the absorptive behavior of each of these modified absorbents especially the Toluenedirsocyanate cellulose and proprietary absorbent sanol®. A significant difference of 18. 4% and 8.4% absorptive capacities were showed by toluene disocyanate cellulose and proprietary Absorbant sanol® in fresh and sea water media respectively.

KEYWORDS

Modified cellulose;
Crude oil;
Fresh water;
Sea water;
Absorption.

INTRODUCTION

The research into the we of biodegradable materials and their modified products as absorbents for the removal; of pollutants like crude oil films from aqueous environment has been on increase. Some of these biodegradable materials include; straw, rice-husks, saw dusts, maize cobs, kenaf roots, kenaf stems, and modified cellulose materials,[1,2,3]. Most of these biodegradable materials are Agricultural waste materials that are naturally occurring, hence, they are abundant readily available at little or no cost. They have advantages over conventional absorbents such as charcoal activated carbon, foam, silica gel, because they are easily available and biodegradable.

Crude oil pollution is any contamination of the environment quality with crude oil as major contaminants. This problem is on increase in most crude oil producing nations as well as crude oil producing na-

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tions as well as crude pill consuming nations[4,5]. Crude oil contaminations arises due to either accidents involving oil tankers, on the road, railways, rivers, fresh water, lakes, sea water, estuaries[6], or accidents involving factures of pipelines, bulk storage tanks, and most cases canalization of oil pipelines[4], carrying crude oil or its refined products. Pollution from leakage of pipelines, careless stocking and handling of crude oil, washings from contaminated surfaces, illegal dumping of crude oil contaminated wastes are common[5]. The effect of crude oil and its refined products pollution are enormous. There effects, however, differ from one environment to another, subject to such physical features such as land, sea, surface water, recreational water, fresh water. For instance crude oil spills on sea and other water bodies can cause the destruction of aquatic life cycles, toxicity to marine lives, clogging of power plants or recreational facilities[3,7,8]. There are numerous factors that affect. The effect of crude oil or its refined products spill on marine lives. These are: type of crude oil spilled such as cresol, phenol, chlorinated hydrocarbons; duration of crude oil spill, frequency of spills, quantity of crude oil spilled, state of crude oil prior to spill, season and habitat of the marine organisms at a particular ecosystem[9,10].

There are two distinctive remediation processes used an crude oil and its refined products spills. These are natural control mechanisms of dissolution, evaporation, spreading and applied methods, containment, sinking, burning, and sorption process[11]. The sorption-controlled remediation process is the subject of this paper using biodegradable absorbent material, cellulose pulps cellulose and its modifies cellulose pulps are used as biodegradable absorbents in the crude oil spill clean operations in the different aqueous environments; fresh water, rivers, lakes estuaries, [12,13] Cellulose is a homopolysaccharide derived from plants. It is a linear compound compose of D-glycopyranose linked together by þ1-4 glycosidic bond[14]. Cellulose has a general chemical formula $(C6H10O5)n$. Where n=5 or more glucose units. Cellulose has three reactive hydroxyl functional groups written as $C6H7O2 (OH)3n$[15]. It is one of the most abundant polysaccharide in plant kingdom. The natural resources of cellulose are, wood, sawdust, elephants grass, cassava peels, yam peels, waste new sprints, wood barks, corncobs, orange peels, banana peels. Cellulose serves as food storage reservoirs for plants, plant protective coat, carbohydrates for ruminants, insects, raw materials for paper industries, pharmaceutical industries, book binding, printing, packaging and a host of other uses[16].

In this study we report the affects of different aqueous environments on the absorptive capacities of modified cellulose pulps as crude oil absorbent.

MATERIALS AND METHODS

Sample collection: crude oil sample was obtained from port Harcourt crude oil flow station, River state, proprietary Absorbent sanol® was collected from shell petroleum development Research laboratory, River state. Waste news prints have were collected from old new papers dumping site at Okigwe, Imo State, Nigeria. All Chemicals used were analytical grade reagents from BDH Chemicals, London.

Sample preparation

The waste newsprints were shredded into particle sizes of 250mm using paper shredder(bin atone model)These waste newsprints were used in the production of Cellulose pulps as described by hunter[17].

The cellulose pulps obtained were Chemically modified using esterification method[18,19]forty-grams of cellulose pulps was weighed out and taken into one-liter volume quick fixed flask containing dichloride methane solvent(400ml).

Initial in refluxing was carried out for 30minutes at 80^0C. Thereafter, 80ml of 10% ethanol NaOH Solution was added as catalyst. Eighty milliliter of benzoylchloride reagent solution was added in a step wise manner during a ten minutes interval. The whole refluxing exercise was carried out for 2.5hr. Thereafter, the solvent used for the refluxing was removed by press-drying the modified cellulose pulp benzoyl modified cellulose(BMC). The modified product was rendered less hygroscopic by further processing as follows, the product was soaked in a plastic container containing 250ml acetone and stirred repeatedly. The acetone solvent was removed by press drying of the soaked product. The modifies product, Benzoyl modified cellulose(BMC), was spread thin film on a clean wooden slab and air-dried for 24hr.

The procedures described above was used exactly in the same manner for carrying out the modification of the other two chemical modification processes. Except that Toluenediisocyanate reagent was used as modifying chemical regents for teluenedisocyanate cellulose(TDC). In case of the blowed cellulose water was used as blowing agent in the further processing of the toluenediisocyanate cellulose to obtain the Toluenediisocyanate cellulose blown (TDC^b).

Absorption studied

Varying simulated crude oil spills were out using 300ml and 300ml each of natural seawater and fresh water respectively. Five glass vessels were set up each containing 300ml of natural sea water. Each labeled flasks of time received o.6, 1.00, 1.50 2.00 and 2.50 mls of crude oil respectively. One gram of Benzoyl modified cellulose(BMC), was each weighed out and uniformly spread over the floating crude oil film in each of the five glass vessels set up. Contact time of 30minutes for sorption equilibrium attainment for each of the vessels were allowed. After each 30minutes contact internal, the floating absorbent with its content(s) was scooped into a separating flask and the absorbed crude oil films desorbed using absolute ethanol solvent. The crude oil extracts from each of the five glass vessels was quantity using spectrophotometeric method at 500nm wavelength[20]. The same benzoyl modified cellulose absorption studies procedures was exactly repeated using 300ml of fresh water for each of the five glass vessels. The amount of crude oil sorbed each of the experimental studies was calculated using direct comparison with standard method[19]. The above experimental procedures were exactly using, toluendiso cyanate cellulose(TDC)material toluendi socyanate cellulose blown(TDC^b) and the proprietary Absorbent sanol® respectively in both the sea water and fresh water media respectively.

RESULTS AND DISCUSSION

The results of the studies on the absorptive behaviour and capacities of modified cellulose pulps in different aqueous media; fresh water and sea water is presented in TABLE 1. From TABLE1 each of these four modified cellulose pulps absorbed more than seventy percent of the spilled crude oil in the two aqueous media investigated. The results showed that increasing concentration of crude oil spills decreases the amount of crude oil absorbed in the two different aqueous environments. The sea water medium has a significant effect on the absorptive behaviour and absorptive capacities mostly on the proprietary Absorbent sanol® and toluenediisocyanate cellulose, causing a significant difference of 8.4% and 18.4% absorption capacities difference in the two absorbents in the sea water environment when compared to the absorption of crude oil by the same absorbent materials in fresh water environment(TABLE 1) These differences may be attributed to competition between the sodium ion Na^+ and chloride in Cl^- in the salty water from the sea meduim for the pore sites in the absorbent and the crude oil films. It may be due to pH differences between fresh water environment and the sea water environment. The decreased absorptive capacities

TABLE 1: Effect of concentration on absorptive behaviour of modified cellulose in different aqueous environment

Modified cellulose type	Constant weight of absorbent used	Variation in the amount of crude oil spilled	Percentage crude oil spilled in different aqueous media.	
			Fresh water	Sea water
Benzoyl modified Cellulose (BMC)	1.00gram	0.6ml	97.20	96.23
" " "	" "	1.00ml	61.96	60.95
" " "	" "	1.00ml	40.63	42.11
" " "	" "	2.00ml	29.95	30.70
" " "	" "	2.50ml	24.13	24.21
Toluene diisocyanate cellulose (TDC)	1.00gram	0.60ml	97.25	88.88
" " "	" "	1.00ml	61.30	57.80
" " "	" "	1.50ml	41.81	40.57
" " "	" "	2.00ml	31.81	30.81
" " "	" "	2.50ml	25.72	24.93
Toluenediisocyanate cellulose blown TDC^b	1.00gram	0.60ml	81.28	98.42
" " "	" "	1.00ml	60.02	60.10
" " "	" "	1.50ml	42.02	42.71
" " "	" "	2.00ml	32.63	32.20
" " "	" "	2.50 ml	25.88	25.49
Proprietary Absorbent sanol®	1.00gram	0.60ml	93.90	75.50
" " "	" "	1.00ml	59.22	56.64
" " "	" "	1.50ml	40.34	39.37
" " "	" "	2.00ml	30.82	30.21
" " "	" "	2.50ml	24.84	24.56

Data are means of four determinations

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of each of the modified cellulose pulps as the concentration of spilled crude oil increases is attributed to decrease in the pore spaces for accommodation more crude oil film at constant absorbent weight. This phenomenon suggests strongly that the mechanism of the uptake of the crude oil films by these modified cellulose pulps is truly as absorption mechanism and not adsorption mechanism.

This study has showed that effective clean up operations of crude oil spills in different aqueous environment using biodegradable modified cellulose is practically feasible project.

Although the aqueous environmental factors like pH, and salty nature of water have to be taken into consideration.

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