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Formulation of Wicking Agent from Polymer Composites

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Abstract

Composites of High Density Polythene, HDPE, and wood sawdust were harnessed in the formulation of wicking agents that could be employed in cleaning oil spills. The method used in compounding the composite of HDPE and various wood sawdust {Uvwero (Buchholzia coriacea), Akomu (Pycnanthus angolensis), Obeche (Triplochiton scleroxylon), Ugbarugba (Copaifera species), and Bombar (Bombax buonopozense)} was an extrusion method which was done at 200°C. The composite of High Density polythene (HDPE)/Akomu/Sand with a ratio of 4:4:1 gave the highest crude oil absorption of 82.16% while the composite of High Density Polythene/Akomu/Sand with a ratio of 5:1:3 gave the lowest oil absorption of 1.67%. The water test of the composite of High Density Polythene (HDPE)/Ugbarugba/Sand with a ratio of 2:6:1 gave the highest water absorption of 60.78% while the composite of High Density Polythene (HDPE)/Bombar/Sand with a ratio of 2:6:1 gave the lowest water absorption of 0.14%. Thus, the composite of High Density Polythene (HDPE)/Akomu/Sand with a ratio of 4:4:1 can serve as an effective medium for crude oil spill clean-up as it would absorb more crude oil than water.

Keywords: Composites, High Density Polythene (HDPE), Wicking agent, Wood sawdust, Extrusion method

INTRODUCTION

Global concerns about environmental sustainability have intensified efforts to develop eco-friendly materials, aiming for a circular, carbon-neutral economy and reducing reliance on non-renewable resources like petroleum-based polymers. This has led to alternative production methods to reduce the harmful effects of excessive plastic use and waste. These alternative methods are focused on lower energy consumption and fewer emissions. With the demand for sustainable alternatives on the rise, wood-polymer composites (WPCs) have

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emerged. These composites entail combining synthetic thermoplastics with lignocellulosic fibres. Recent studies address the challenges and opportunities for WPC applications highlighting advances in WPC formulations, emphasising benefits from matrix and filler compositions, interphase modifications, natural reinforcements, and recycled plastics. (Ayana *et al.,* 2024). Despite the potential benefits of carbon powder as a waste material, its feasibility and effectiveness as a mineral filler in hot mixed asphalt was evaluated, showing the replacement of conventional filler material with carbon powder across varying percentages led to maximum stability at a specific bitumen content. These findings highlight the importance of optimising material composition to achieve desired properties, a principle equally relevant to the development of WPCs (Ladan *et al.,* 2024). When producing WPCs as functional fillers, natural wood and wooden fibres are used to improve the properties of the composite, contrasting with the use of talc, chalk, and inorganic fibres in classic industrial processing of synthetic polymers. Given that wood is an organic polymer, it is significantly more susceptible to degradation factors, making the potential applications of WPCs highly dependent on filler characteristics and matrix-filler interaction. (Španić *et al.,* 2014).

Wood-plastic composites (WPCs) refer to composites that are composed of wood and non-wood fibers and thermoset and thermoplastic polymers. Thermoset polymers used in WPCs are classified as polymers that cannot be melted by heating. Epoxies and phenolic resins are examples of these polymers. Thermoplastic polymers are plastics that can be repeatedly melted, which allow wood fibres to be mixed with the plastic to form WPC products. Common thermoplastics for WPCs manufacture are polypropylene (PP), polyethylene (PE), and polyvinyl chloride (PVC). (Yadav *et al.,* 2021). The WPC manufacturing process usually consists of two steps, i.e., the compounding and the forming. Briefly, the compounding process of wood and other additives is performed to produce a homogeneous composite material by incorporating into a molten thermoplastic. The composite material is then formed into a product, and profile extrusion, injection moulding, and compression moulding are used as the common forming processes (Yadav *et al.,* 2021; Clemons, 2002). Fillers can be used in order to enhance the physical and mechanical properties of WPC. The wood flour can be modified by acetylation, grafting silane, heating, and sodium hydroxide treatment to improve the physical and mechanical properties. (Yadav *et al.,* 2021 and Faruk & Matuana, 2008). Furthermore, mineral fillers like sand can also be added to WPCs to improve their bulk, weight, and dimensional stability. By selecting and combining different fillers and modifications, it's possible to tailor the properties of WPCs to meet specific application requirements. So, the choice of filler depends on the desired properties of the final composite.

Wood fibers usually contain cellulose, hemicellulose, pectin, lignin, water-soluble ingredients, and wax (Hong *et al.,* 2020 and John & Thomas 2008). The actual composition of these materials in wood fibers, though, varies from species to species. Here, water-soluble constituents and wax are considered as extractives since cellulose, hemicellulose, and lignin are considered to be the basic components with regard to physical properties (Yadav *et al.,* 2021 and John & Thomas, 2008). Generally, more than 50% of wood fibers are cellulose. Wood fibers are considered as hollow cellulose fibrils that are bonded together by a lignin and hemicellulose complex matrix (Yadav *et al.,* 2021; Jayaraman, 2003).

In environmental management, especially in the Niger Delta for oil spill cleanup, the formulation of wicking agents using composites of polythene bags (High Density Polyethene-HDPE), wood sawdust, and sand as the filler can be helpful. This study explores the wicking ability of these composites to effectively minimise water uptake while absorbing crude oil.

MATERIALS AND METHODS

Study Area
The five (5) Sawdust wood samples used for the investigation were obtained from Udu Sawmill from Udu local government delta state. The Udu sawmill is close to Udu river, which enables timbers of wood to be transported easily from different parts of the state to the wood sawmill. The mineral and sand that was used for the investigation were obtained from Agbarho sand beach, which is in Uvwie local government.

Materials
In the production of a wicking agent using different polymeric materials, two polymeric materials were used and they are wood sawdust and waste polythene bags. The wood samples used in this investigation were obtained from Udu saw mill, Delta state, Nigeria. The wood samples were obtained by a method of handpicking. This involved using a large wooden clip to pick up sawdust materials and placing them into labelled transparent polythene bags for easy identification. The wood sawdust samples were sun dried. The common names and scientific names of the wood sawdust are Akomu (Pycnanthus angolensis), Bombar (Bombax buonopozense), Obeche (Triplochiton scleroxylon), Ugbarugba (Copaifera species), Uvwero (Buchholzia coriacea).

The waste polythene bags were collected literally from different locations in federal University of Petroleum Resources Effurun environs. These polythene bags were collected by handpicking, washed with distilled water and sun dried. Mineral sand was obtained from Agbarho beach. It was added to the polymeric wood and polythene bags to increase porosity. The water used in the experiment was obtained from the tap in Federal University of Petroleum Resources Effurun. The crude oil used in the experiment was obtained from Nigeria Petroleum Development Company, NPDC.

METHOD

Pelletisation of the waste polythene material
Mixing
After drying the wood saw dust, the sand of 0.300mm, the pelletized waste polythene bags were mixed inside a jar (container) with a mixer in the following ratio 5:3:1 w/w, 5:2:2w/w, 5:1:3w/w, 3:5:1w/w, 2:6:1w/w,4:3:2w/w, 3:4:2w/w, 1:4:4w/w using 5 different wood saw dust sample. (Ramesh, *et al.,* 2022; Yadav *et al.,* 2021)

Extrusion
The mixture was channelled into the hopper of the Extruding machine, which produced the hot mixed composite or extrudate. The extrudate was placed in a 12 X 4 X 1 cm rectangular metallic mould. The Extrudate was then allowed to cool. The extruding operation was carried out at 200°C. (Ramesh, *et al.,* 2022; Yadav *et al.,* 2021)

Wicking test
The wicking agents that were prepared were tested for their water and crude oil absorption.

Water absorption test
The labelled 45 wicking agents produced were weighed in an electric weighing balance to determine their initial mass. They were immersed in a rectangular-shaped container that contained 2000 mL (2L) of water fetched from the Federal University of Petroleum Resources Effurun tap. The wicking agents were allowed to stay in the water for 4 hours interval for 3 times. At the end of each 4 hours, the wicking agents were removed from the water with a

forcep which was formerly cleaned with diluted Trimethylamine, C_3H_9N, and then allowed to dry at ambient temperature. Thereafter, the wicking agent's mass was obtained by weighing in the same electronic weighing balance used and the percentage of water absorption was calculated.

Crude oil absorption test

The labelled 45 wicking agents produced were weighed in an electric weighing balance to determine their initial mass. They were immersed in a rectangular-shaped container that contained 1000 mL (1L) of crude oil. The wicking agents were allowed to stay in the crude oil for 4 hours interval for 3 times. At the end of each 4 hours, the wicking agents were removed from the crude oil with a forcep which was formerly cleaned with diluted Trimethylamine, C_3H_9N and then allowed to dry at ambient temperature. Thereafter, the wicking agent's mass was obtained by weighing in the same electronic weighing balance used and the percentage of crude oil absorption was calculated wicking agent before immersion

RESULTS

Table 1: Effect of mixing ratios on the absorption of water and water absorption properties

Ratios H/Uv/S	Initial mass (g)	Mass(g) at time (t)			Water absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	44.1269	44.8397	45.0034	45.0593	1.62	1.99	2.11
5:2:2	31.0082	31.0934	31.1227	31.1332	0.28	0.37	0.40
5:1:3	33.2827	33.3286	33.3423	33.3846	0.14	0.18	0.31
3:5:1	39.6150	44.8293	44.8710	44.9330	13.16	13.27	13.42
2:6:1	33.0503	39.8116	41.2790	41.9032	20.46	24.90	26.79
4:3:2	34.0163	34.0331	34.3450	34.9956	0.05	0.97	2.88
3:4:2	48.6475	50.9019	51.3811	51.7550	4.63	5.62	6.39
1:4:4	39.7590	41.4139	41.5512	41.9559	4.16	4.41	5.53
4:4:1	44.8039	46.3216	46.3400	45.7013	3.39	3.43	4.23

(H: High Density Polythene, Uv: Uvwero wood sawdust, S: Sand)

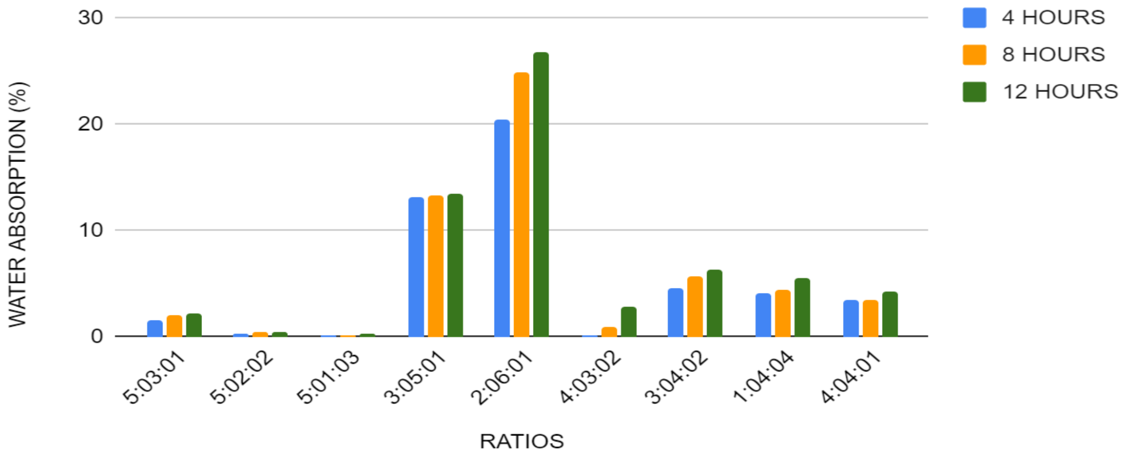

Fig 1: A Bar chart of water absorption against time at intervals for Uvwero composite

Table 2: Effect of mixing ratios on the absorption of water and water absorption properties

Ratios H/Ak/S	Initial mass (g)	Mass(g) at time (t)			Water absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	38.7173	38.7328	38.7548	38.9312	0.04	0.01	0.55
5:2:2	33.7346	33.7450	33.7840	33.8262	0.03	0.15	0.27
5:1:3	39.8418	39.8851	39.9087	39.9393	0.11	0.17	0.25
3:5:1	51.9535	55.0957	55.3108	62.1726	6.05	6.46	19.67
2:6:1	35.7452	43.1109	44.1309	54.3129	20.61	23.46	51.93
4:3:2	39.6949	40.0047	40.2362	40.6029	0.78	1.36	2.29
3:4:2	36.2047	37.4307	37.7242	39.5215	3.39	4.20	9.16
1:4:4	44.2814	45.0735	45.5290	46.7358	1.79	2.82	5.54
4:4:1	45.7575	46.6870	46.6967	46.9957	0.02	2.05	2.71

(H: High Density Polythene, Ak: Akomu wood sawdust, S: Sand)

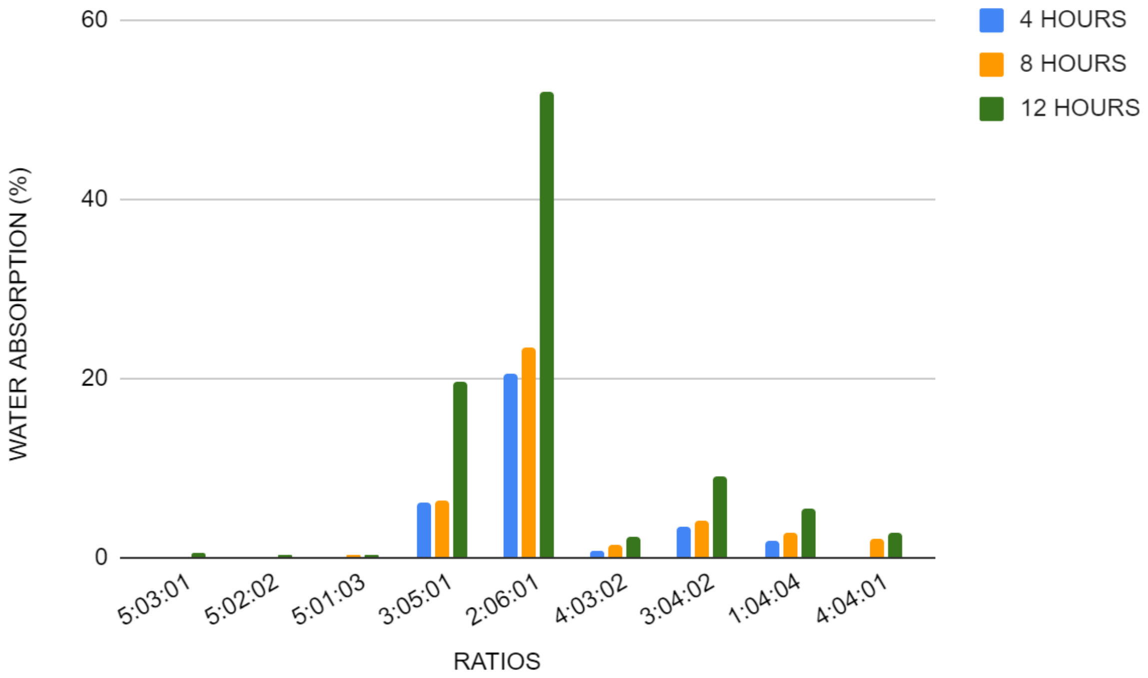

Fig 2: A Bar chart of water absorption against time at intervals for Akomu composite.

Table 3: Effect of mixing ratios on the absorption of water and water absorption properties

Ratios H/Ob/S	Initial mass (g)	Mass(g) at time (t)			Water absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	29.5290	29.6151	29.7083	29.7457	0.29	0.61	0.73
5:2:2	35.9438	36.0941	36.1045	36.1657	0.42	0.45	0.62
5:1:3	33.9802	34.0364	34.0551	34.0847	0.17	0.22	0.31
3:5:1	32.4838	38.3515	38.6108	39.4466	18.06	18.86	21.42
2:6:1	33.1510	41.0051	41.1437	41.9203	19.68	20.08	22.35
4:3:2	50.5020	51.6331	51.7550	52.0889	2.24	2.48	3.14
3:4:2	33.1511	38.8838	39.0718	40.1258	17.29	17.29	21.04
1:4:4	37.9038	40.6075	40.7276	41.7236	7.13	7.45	10.078
4:4:1	43.8318	45.9275	46.2255	46.3897	4.78	5.46	5.84

(H: High Density Polythene, Ob: Obeche wood sawdust, S: Sand)

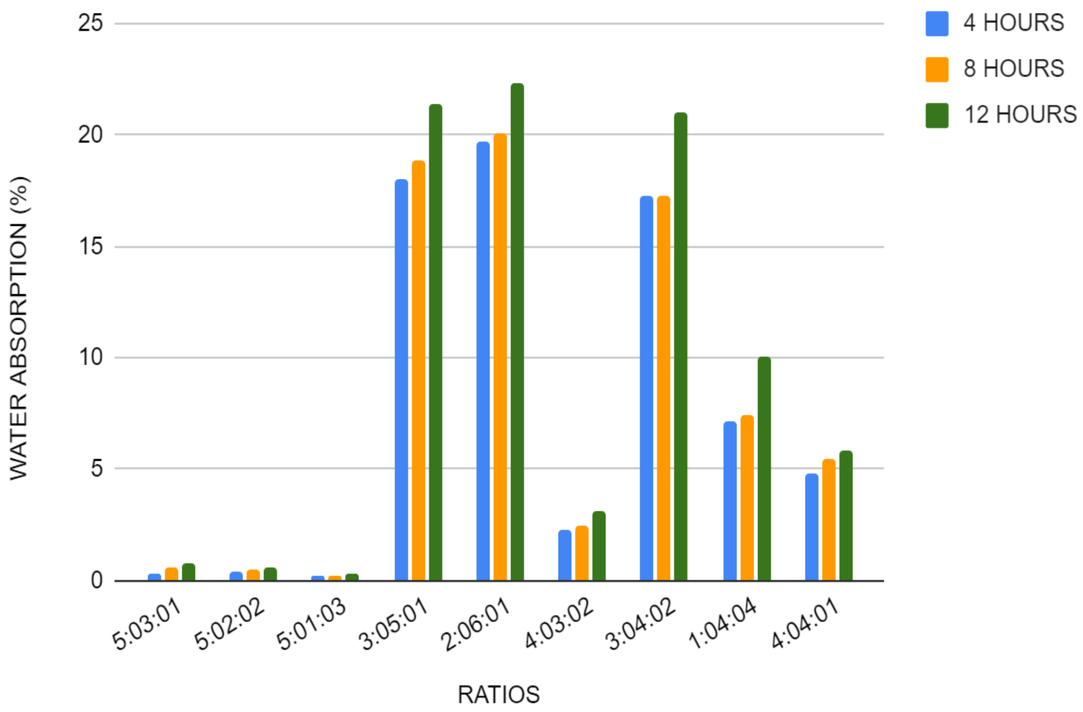

Fig 3: A Bar chart of water absorption against time at intervals for Obeche composite

Table 4: Effect of mixing ratios on the absorption of water and water absorption properties

Ratios H/Ug/S	Initial mass (g)	Mass(g) at time (t)			Water absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	37.5765	38.1400	38.1708	38.1837	1.50	1.58	1.62
5:2:2	47.6308	47.7553	47.7720	47.9186	0.32	0.35	0.66
5:1:3	37.4822	37.5402	37.6271	37.6838	0.16	0.39	0.54
3:5:1	40.0677	43.8796	44.2524	45.3904	9.5	10.44	13.28
2:6:1	29.7241	40.4681	46.6262	47.7894	36.14	56.86	60.78
4:3:2	39.0213	42.0670	42.2764	42.7771	7.81	8.34	9.63
3:4:2	34.6467	37.8324	38.5554	38.6265	9.20	11.28	11.47
1:4:4	33.1289	33.8793	34.6852	36.5609	2.27	4.50	10.13
4:4:1	34.0308	36.0254	36.3312	36.8543	7.13	7.45	10.08

(H: High Density Polythene, Ug: Ugbarugba wood sawdust, S: Sand)

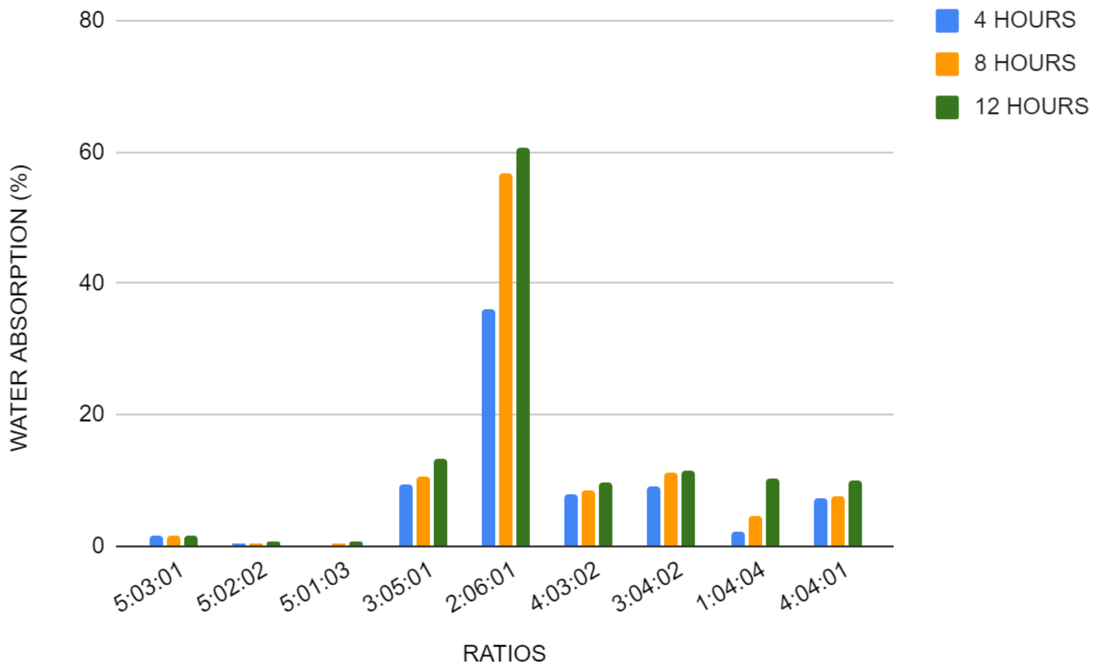

Fig 4: A Bar chart of water absorption against time at intervals for Ugbarugba composite

Table 5: Effect of mixing ratios on the absorption of water and water absorption properties

Ratios H/Bm/S	Initial mass (g)	Mass(g) at time (t)			Water absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	36.7548	37.6186	37.8352	37.9035	2.35	2.94	3.13
5:2:2	37.3812	38.1218	38.3596	38.3697	1.98	2.61	2.64
5:1:3	34.1657	34.1791	34.1880	34.2149	0.04	0.065	0.14
3:5:1	31.5576	38.6168	39.1005	39.3714	22.37	22.41	24.76
2:6:1	24.7820	35.5333	37.3723	38.1822	43.38	50.80	54.07
4:3:2	37.5791	40.1944	40.2691	40.3364	6.96	7.16	7.34
3:4:2	33.4046	38.0100	38.6291	39.2212	13.79	15.64	17.41
1:4:4	32.8665	35.8426	35.8531	36.1264	9.06	9.09	9.92
4:4:1	33.6959	36.1032	36.8201	36.8201	7.14	8.53	9.27

(H: High Density Polythene, Bm: Bombar wood sawdust, S: Sand)

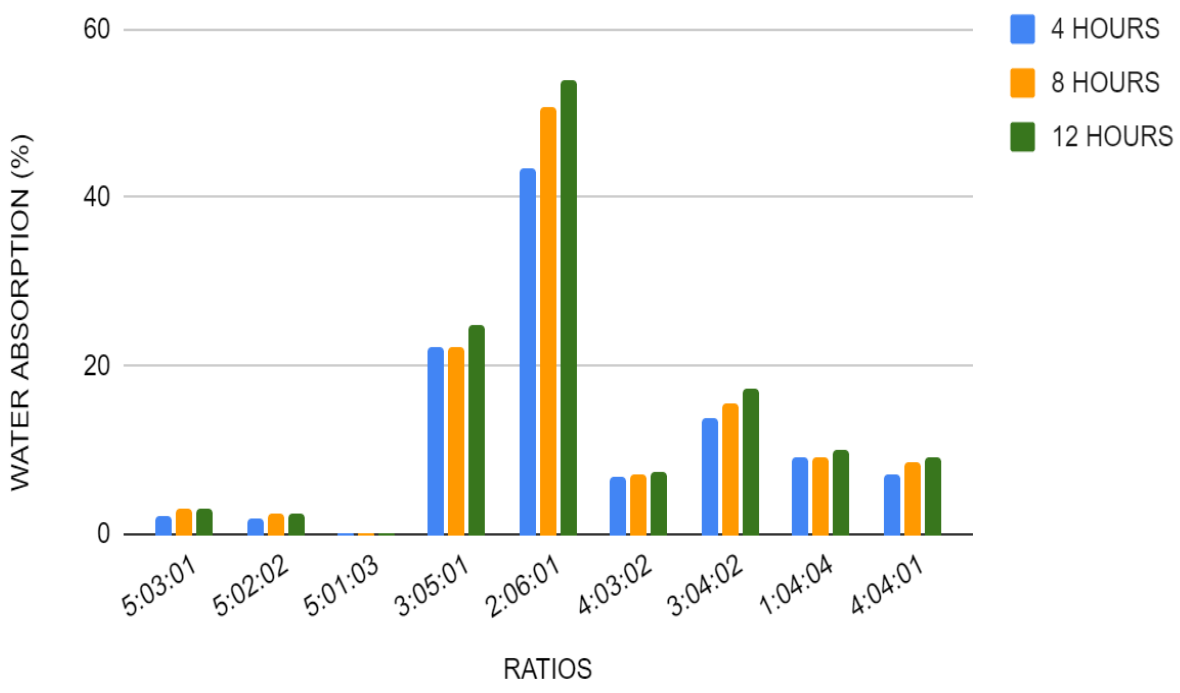

Fig 5: A Bar chart of water absorption against time at intervals for Bombar composite

Table 6: Effect of mixing ratios on the absorption of crude oil and the effect of time of immersion on crude oil absorption (H: High Density Polythene, Uv: Uvwero wood sawdust, S: Sand)

Ratios H/Uv/S	Initial mass (g)	Mass(g) at time (t)			Crude oil absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	44.1268	46.6624	46.7534	47.9002	5.75	5.95	8.55
5:2:2	31.0080	31.0169	33.2106	33.3246	0.029	7.46	7.47
5:1:3	33.2826	33.9054	34.9061	36.0351	1.87	2.88	8.27
3:5:1	39.6147	45.6193	45.9734	46.5981	15.16	16.05	17.63
2:6:1	33.0502	40.5671	40.6034	41.4540	22.74	22.85	25.43
4:3:2	34.0160	34.1093	35.1120	36.2460	0.27	3.22	6.56
3:4:2	48.6474	52.7191	53.3254	56.1904	8.37	9.62	15.51
1:4:4	39.7587	43.2596	43.3371	44.7094	8.81	9.00	12.45
4:4:1	44.8037	47.6703	48.5400	49.4433	6.40	8.34	10.36

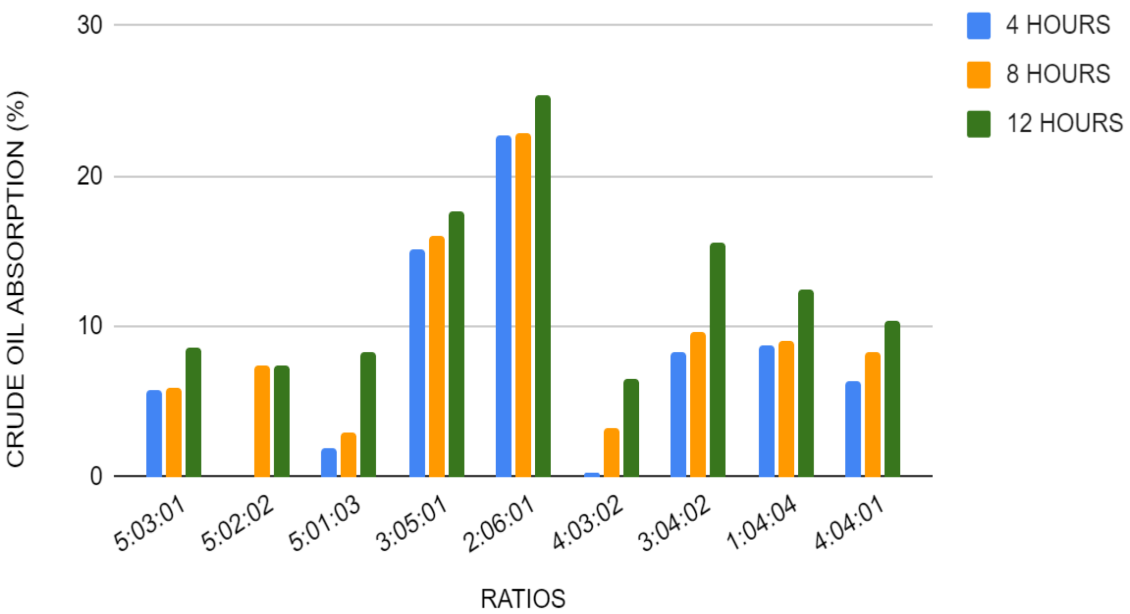

Fig 6: A Bar chart of crude oil absorption against time at intervals for Uvwero composite

Table 7: Effect of mixing ratios on the absorption of crude oil and the effect of time of immersion on crude oil absorption (H: High Density Polythene, Ak: Akomu wood sawdust, S: Sand)

Ratios H/Ak/S	Initial mass (g)	Mass(g) at time (t)			Crude oil absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	38.7170	40.6194	40.8925	41.0753	4.91	5.62	6.09
5:2:2	33.7345	34.5672	34.6510	34.8972	2.47	2.72	3.45
5:1:3	39.8417	39.8634	40.3572	40.5069	0.06	2.05	1.67
3:5:1	51.9534	52.4280	55.1025	61.1267	0.91	6.06	17.66
2:6:1	35.7451	47.1797	48.9042	49.3559	31.99	36.81	38.08
4:3:2	39.6948	41.2956	42.5149	42.5226	4.03	7.11	7.12
3:4:2	36.2046	40.5882	42.4104	43.2075	12.11	17.14	19.34
1:4:4	44.2813	48.0848	49.1215	49.6661	8.59	10.93	12.16
4:4:1	45.7573	48.5110	63.3058	65.1354	35.67	77.04	82.16

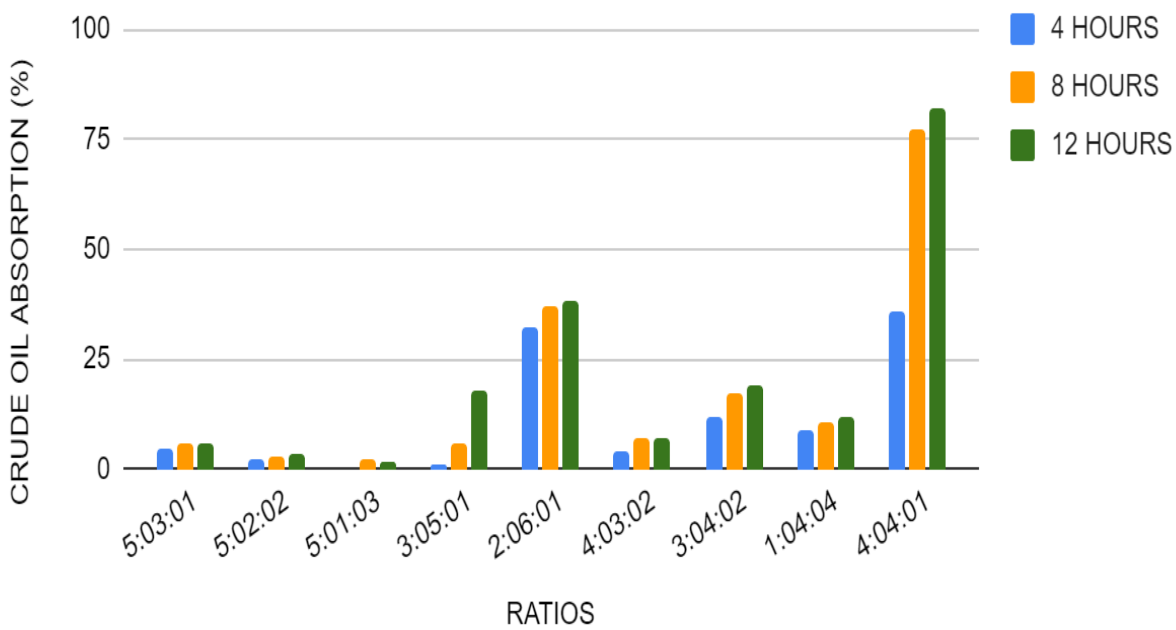

Fig 7: A Bar chart of crude oil absorption against time at intervals for Akomu composite

Table 8: Effect of mixing ratios on the absorption of crude oil and the effect of time of immersion on crude oil absorption (H: High Density Polythene, Ob: Obembe wood sawdust, S: Sand)

Ratios H/Ob/S	Initial mass (g)	Mass(g) at time (t)			Crude oil absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	29.5290	30.5297	30.6141	30.9132	3.39	3.68	4.69
5:2:2	35.9438	36.1057	36.2472	37.0672	0.45	0.84	3.13
5:1:3	33.9802	41.1168	42.1716	42.9716	21.00	24.11	26.52
3:5:1	33.1510	38.9068	40.5502	42.5612	19.77	24.83	31.02
2:6:1	34.2623	40.5214	53.5123	55.5732	18.27	56.18	62.20
4:3:2	50.5019	51.6955	53.7512	56.8574	2.36	6.43	12.59
3:4:2	33.1510	39.0577	40.6313	41.3215	17.82	22.56	24.65
1:4:4	37.9037	42..2411	43.7416	44.8917	11.44	15.40	18.44
4:4:1	43.8318	46.8970	47.8812	48.9843	6.99	9.24	11.76

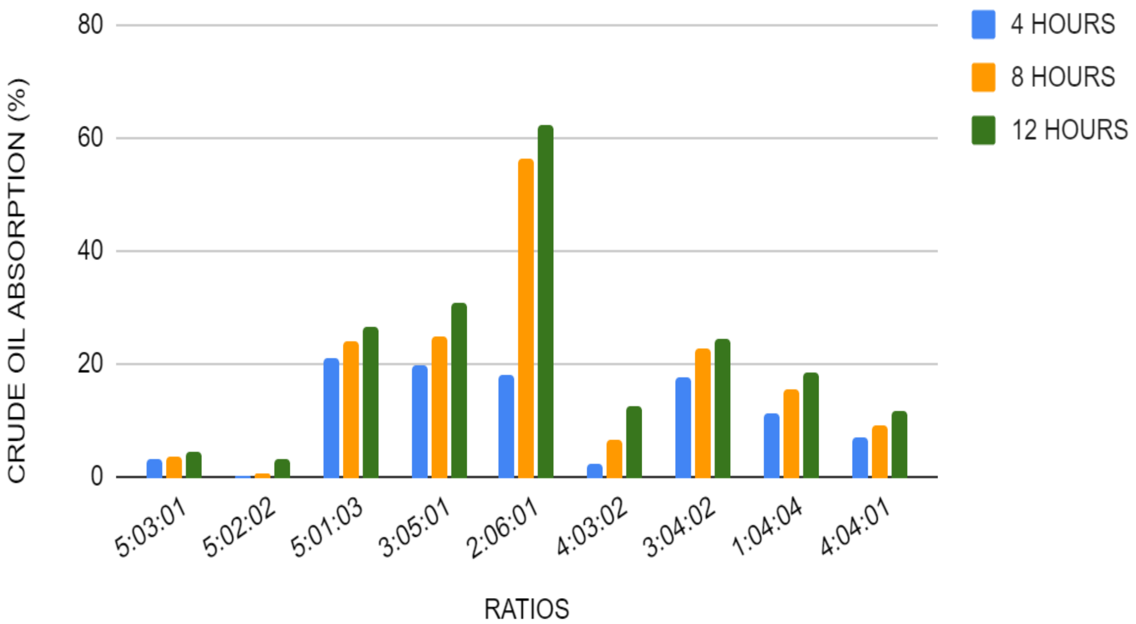

Fig 8: A Bar chart of crude oil absorption against time at intervals for Obembe composite

Table 9: Effect of mixing ratios on the absorption of crude oil and the effect of time of immersion on crude oil absorption (H: High Density Polythene, Ug: Ugbarugba wood sawdust, S: Sand)

Ratios H/Ug/S	Initial mass (g)	Mass(g) at time (t)			Crude oil absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	37.5763	39.0169	39.4048	39.9404	3.8338	4.8661	6.2915
5:2:2	47.6037	48.9112	49.3016	50.5236	2.7466	3.5667	6.1338
5:1:3	37.4821	38.4803	38.6842	39.6772	2.6631	3.2071	5.8564
3:5:1	40.0676	47.0142	48.4372	49.9736	17.3372	20.8887	24.7232
2:6:1	29.7240	42.7008	44.2498	47.5733	43.6577	48.8689	60.0501
4:3:2	39.0211	43.2832	44.2021	46.4441	10.9226	13.2774	19.0230
3:4:2	34.6463	41.2903	41.6898	41.8652	19.1767	20.3297	20.8360
1:4:4	33.1286	35.5756	35.9057	36.0146	7.3864	8.3828	8.7115
4:4:1	34.0305	37.3262	37.6445	38.1726	9.6846	10.6199	12.1717

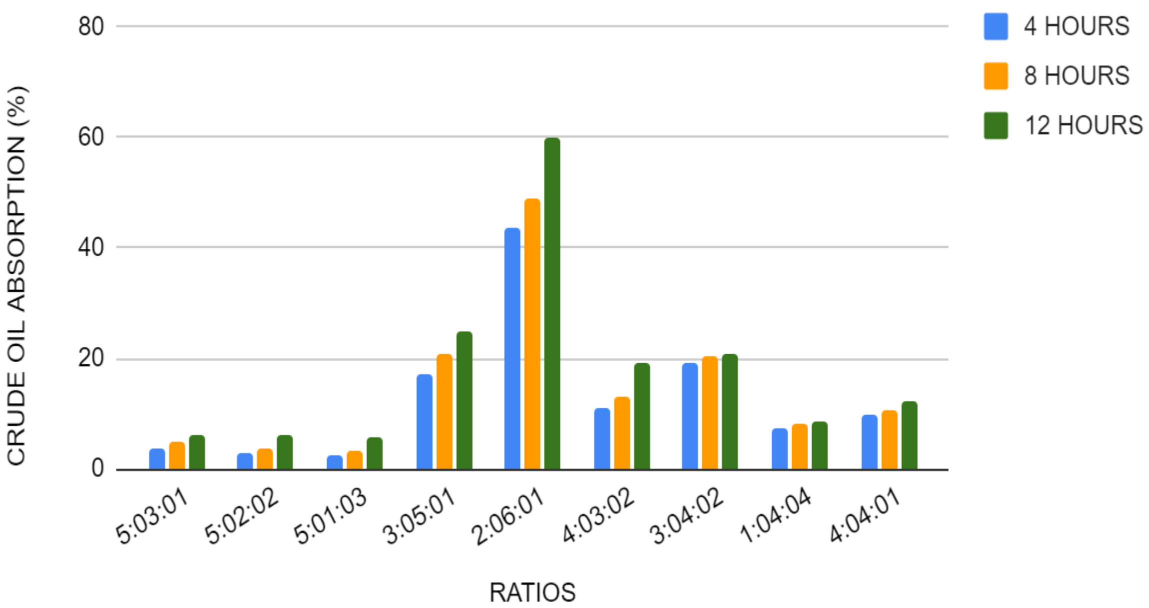

Fig 9: A Bar chart of crude oil absorption against time at intervals for Ugbarugba composite

Table 10: Effect of mixing ratios on the absorption of crude oil and the effect of time of immersion on crude oil absorption (H: High Density Polythene, Bm: Bombar wood sawdust, S: Sand)

Ratios H/Bm/S	Initial mass (g)	Mass(g) at time (t)			Crude oil absorption (%) at time (t)		
		1st 4 hours (4 hours)	2nd 4 hours (8 hours)	3rd 4 hours (12 hours)	1st 4 hours (4 hours)	12nd 4 hours (8 hours)	3rd 4 hours (12 hours)
5:3:1	36.7544	37.4708	38.6586	39.7859	1.95	5.18	8.25
5:2:2	37.3810	39.0408	39.1398	39.9998	4.44	4.71	7.01
5:1:3	34.1653	34.2175	34.6324	35.7586	0.15	1.38	4.66
3:5:1	31.5575	38.7219	38.9790	39.0541	21.35	23.52	23.76
2:6:1	24.7819	34.4226	34.7636	35.0621	38.90	40.29	41.48
4:3:2	37.5790	40.7806	40.8971	41.2352	8.52	8.83	9.73
3:4:2	33.4045	37.9457	38.0841	40.2177	13.60	14.01	20.40
1:4:4	32.8664	36.3613	36.5346	36.6328	10.63	11.16	11.46
4:4:1	33.6955	36.5831	36.7499	38.6163	8.60	9.06	15.63

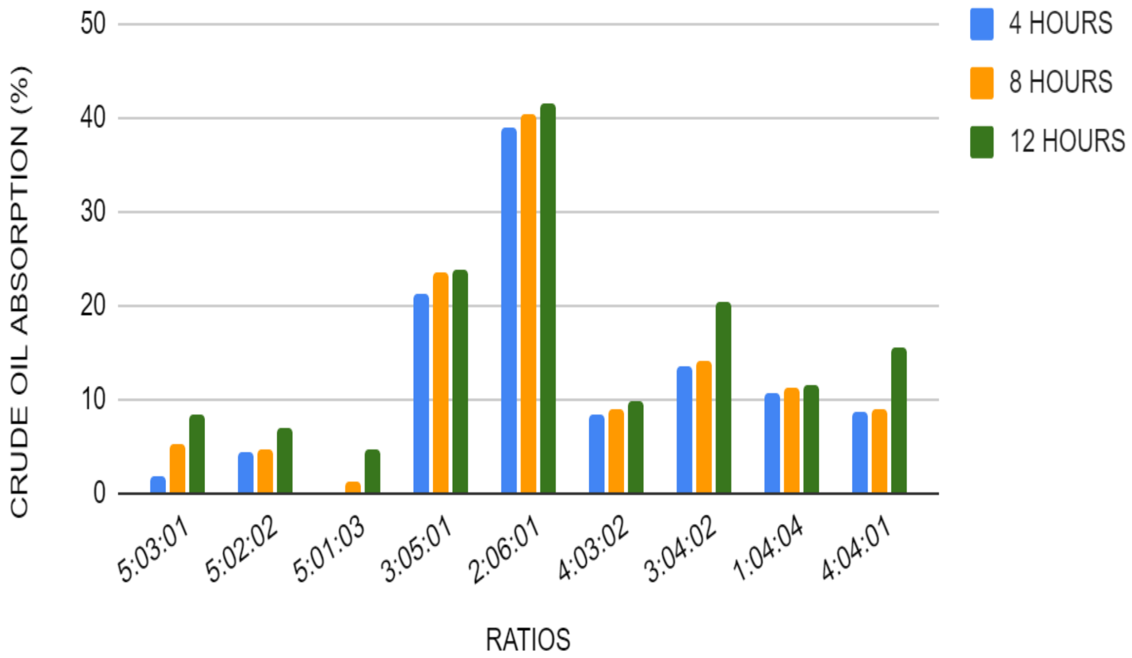

Fig 10: A Bar chart of crude oil absorption against time at intervals for Bombar composite

The water absorption test revealed that each of the wicking agents were shown to be effective in absorbing water by water absorption test as there was an increasing mass of the wicking agents at different progressive time intervals. The composites with higher wood content showed greater water absorption, ranging from 0.14% to 60.78% after 12 hours. The Ugbarugba, Bombar, and Akomu composites with a ratio of 2:6:1 exhibited the highest absorption, while Bombar with a 5:1:3 ratio had the lowest at 0.14%. Higher wood content increased water residence sites, while higher plastic content reduced them. Water absorption was mainly attributed to cellulose fibres in the wood, the gaps between wood and polymer, and the formation of micro-pores.

The crude oil absorption test revealed that the wicking agents effectively absorbed crude oil, with increasing mass over time. As shown from Table 7 to Table 11, crude oil absorption varied across different wood sawdust composites. Akomu with a 4:4:1 ratio exhibited the highest absorption (82.16%), while Akomu with a 5:1:3 ratio had the lowest (1.67%). Obeche with a 2:6:1 ratio also showed high absorption (62.20%). Lower absorption rates in certain ratios, such as Akomu (5:1:3) and Obeche (5:2:2), were due to the higher polymer content in the composites.

DISCUSSION

Natural fiber-based polymer composites are poorly water resistant due to the presence of polar groups, which attract water molecules through hydrogen bonding. The hydrophilic nature of wood flour causes wood plastic composites to absorb water. It is well established that the water absorption in natural fiber thermoplastic composites is mainly due to the presence of hydrogen bonding sites in the natural fibers (Falih 2015; Behzad Kord 2011). Cellulose and hemicelluloses are mostly responsible for the high water absorption of natural fibers, since they contain numerous accessible hydroxyl groups. As cellulose fiber is the main component in the wood flour, the absorbed water mostly resides in the regions such as the lumens, the cell wall, and the gaps at the interface between the wood flour and the polymer matrix. As the wood flour loading increased, the cellulose content increased, which in turn resulted in the absorption of more water (Falih, 2015). And due to this reason, the WPCs have the potentiality to uptake water under humid conditions. Similar results for increasing patterns of water absorption were also reported by (Hossain *et al., 2014*), which study the effects of wood properties on the behaviours of wood particle reinforced polymer matrix composites. In composites with higher wood flour contents, water absorption, increased more rapidly. Because higher wood content will cause stresses within the material and create voids and microcracks, due to the poor interfacial bonding between the wood flour and the polymer matrix. When the composites have been immersed in water, the capillary action conducts the water molecules in the material and fills in the voids and cracks in the composites (Falih 2015; Abdul 2011), but for the wicking agents with low water absorption, this is due to the fact the wood sawdust was enclosed in the polymer matrix and there is a decrease of gap between the woodsawdust and the polythene

CONCLUSION

The results showed that the wicking agents have a higher percentage of water absorption than oil absorption, except for the 4:4:1 and 2:6:1 wicking agents prepared with Akomu and Obeche wood sawdust, which absorbed more oil than water. It was expected that as wood sawdust content increases in each wicking agents, that there would be an increase in water absorption than oil absorption of these wicking agents but this was not the case as the wicking agents made with Akomu and Obeche increase in percentage crude oil absorption than water. Thus, the wicking of the crude oil by the wicking agent is independent of the nature of the composite material, arrangement and compatibility of the polymer Matrix. Also the wicking agent made with Akomu (4:4:1) and Obeche (2:6:1) .

When placed in a liquid environment containing water and oil, it selectively absorbs more crude oil than water. Since the matrix absorbed more crude oil than water, it suggests that the composites should be used as an effective medium for combating crude oil spills. This can suggestively be a good crude oil spill response emergency technique.

It is suggested that further research should be carried out on wood polymer composite. using different polymer composites to still combat oil spill

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