gen containing functional groups from the modifying agents.

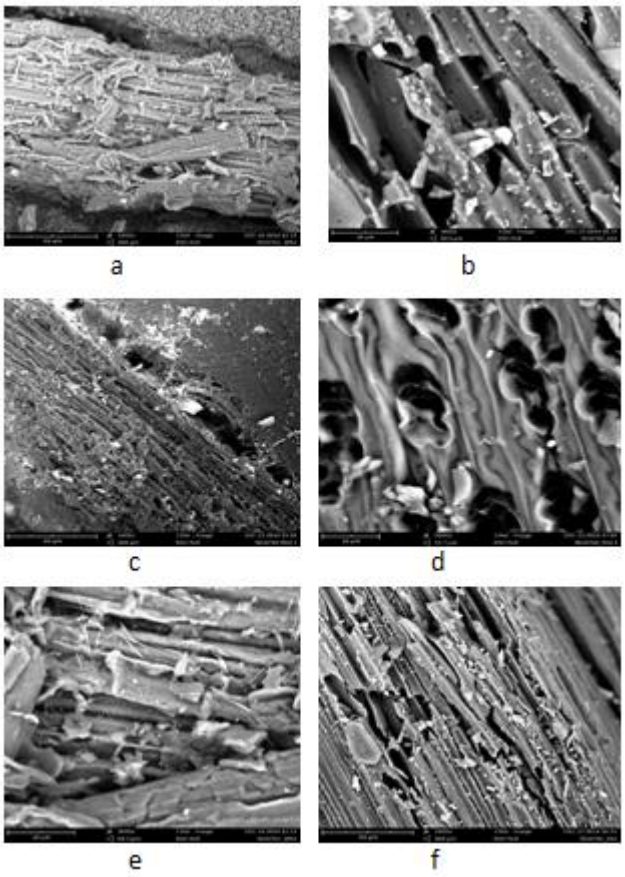

Figure 1: SEM images of (a) unmodified millet straw activated carbon, (b) unmodified sorghum straw activated carbon, (c) nitric acid modified millet straw activated carbon, (d) nitric acid modified sorghum straw activated carbon, (e) sodium hydroxide modified millet straw activated carbon and (f) sodium hydroxide modified sorghum straw activated carbon

3.2. Iodine number

Table 1 showed that the iodine numbers of the unmodified activated carbons (UMS and USS) were 689.3mg/g and 565.4mg/g, and after modification with nitric acid and sodium hydroxide higher iodine number values were obtained as presented in Table 1. Between the two modifying agents used nitric acid improves the pore structure and surface area of the activated carbons more there by leading to enhanced adsorptive capacity. Similar results were obtained by other researchers; [1] observed that the adsorption of Cr (III) was increased on oxidation of granular activated carbons with nitric acid, hydrogen peroxide and ammonium persulphate in aqueous solution. Another report [11] showed that the incorporation of acidic oxygen functional groups into activated carbon by HNO_3 oxidation dramatically enhanced the adsorption of cadmium ions from aqueous solution. The adsorption of Perchlorate (ClO_4^-) from aqueous solution was examined with ammonia treated activated carbon by [6]; the researchers noted that higher adsorption capacity for perchlorate was achieved without undermining the pore structure.

3.3. Effect of Contact Time

The effect of contact time on I_2 adsorption efficiency using the modified activated carbons showed that about 80 % of I_2 was absorbed by millet straw activated carbon while 72 % of I_2 was absorbed by sorghum straw activated carbon within 1 hr, while about 89 % of I_2 was absorbed by millet straw and 77 % of I_2 was observed by sorghum straw after 2 hrs.

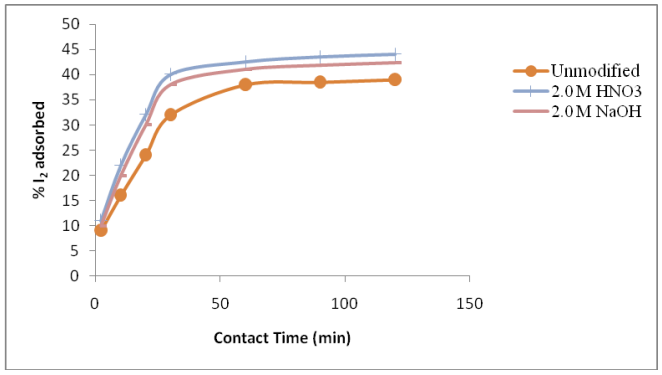

Figure 2: The percent iodine adsorbed against contact time by unmodified millet straw activated carbon and the various modified millet straw activated carbon (2.0 M HNO_3 and 2.0 M NaOH) using 1.0 M KOH at 600 ^oC

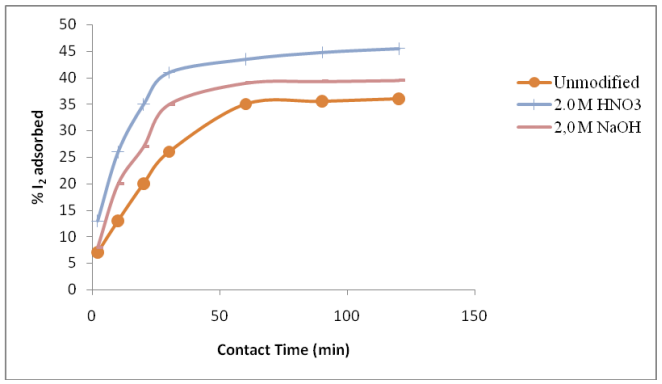

Figure 3: The percent iodine adsorbed against contact time by unmodified sorghum straw activated carbon and the various modified sorghum straw activated carbon (2.0 M HNO_3 and 2.0 M NaOH) using 1.0 M KOH at 600 ^oC

3.4. Adsorption Isotherms

Table 2 represents the Langmuir and Freundlich isotherm parameters for adsorption of iodine. It was found that the

equilibrium data were fitted into both isotherm models with R^2 of the modified activated carbons being higher (0.964, 0.973) than those of the unmodified activated carbons (0.759, 0.828).

K_F and $\frac{1}{n}$, indicated normal adsorption [9] and the maximum monolayer coverage (Q^o) was also found to be generally higher in the modified activated carbons (50.0 mg/g and 47.62 mg/g) compared to the unmodified activated carbons (2.976 mg/g and 3.311 mg/g).The equilibrium parameter (R_L) was found to be greater than zero but less than 1 indicating that all the adsorption processes were favourable [17].

4. Conclusion

The present study highlighted the importance and relevance of chemical modification of the surface chemistry of activated carbon produced from *Pennisetum glaucum* and *Sorghum bicolor*. SEM images and FTIR analysis showed increased pore formation and increase in the number of surface functional groups as a result of the modification treatment. A significant increase in iodine number was achieved after modification, but the best results was obtained for the nitric acid modified activated carbon samples; between the two precursors studied, nitric acid modified sorghum straw activated (MSS) apparently absorbed higher amount iodine (I_N=911.2 mg/g).

Table 1: Iodine Number (I_N) Values of Unmodified and Modified Activated Carbon

Unmodified Activated carbon	Iodine Number mg/g	Modified Activated carbon	Modifying Agents (2.0 M)	Iodine Number (mg/g)
UMS	689.3	MMS	HNO_3 NaOH	898.0 835.5
USS	565.4	MSS	HNO_3 NaOH	911.2 595.2

Key:
UMS – Unmodified Millet Straw Activated Carbon, USS- Unmodified Sorghum Straw Activated Carbon.
MMS – Modified Millet Straw Activated Carbon, MSS- Modified Sorghum Straw Activated Carbon.

Table 2: Freundlich and Langmuir Parameters for Adsorption of Iodine unto Modified and Unmodified Activated Carbon

Activated Carbon	Freundlich parameters $\frac{1}{n}$ n K_f	Langmuir parameters Q^o K R_L	Correlation coefficients Freundlich Langmuir (R^2)
MMS	0.382 2.62 5.90	50.0 5.03 x 10^{-2} 2.95 x10^{-2}	0.964 0.732
MSS	0.4 2.5 4.94	47.62 4.56 x 10^{-2} 3.34 x 10^{-2}	0.973 0.716
UMS	0.302 3.31 3.60	2.976 0.316 4.936 x10^{-3}	0.759 0.758
USS	0.312 3.21 2.838	3.311 0.239 6.515x10^{-3}	0.828 0.829

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