ADSORPTION OF NITRO COMPOUNDS FROM AQUEOUS SOLUTIONS ON ACTIVATED CARBONS

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INTRODUCTION

Limited work is reported (1-3) on adsorption studies of aromatic nitro compounds on activated carbon. Many of the polynitro compounds used as military explosives are either toxic or produce toxic by-products during their manufacture. Discharge of waste waters containing such toxic substances even in very low concentration threatens aquatic life. To meet the stringent environmental standards, some studies have been carried out to treat the explosive effluents with activated carbons (4-6). Consequently, it was thought of interest to study the adsorption of these toxic nitro compounds using granulated activated carbons (GAC).

EXPERIMENTAL

To study the isotherms, commercial grade activated carbons with surface areas varying between 650 to 1300 m^2/g were used. A known quantity of each carbon was placed in contact with 50ml aqueous solutions of nitrobenzene (NB), trinitrotoluene (TNT), picric acid (PA) and styphnic acid (SA). The concentration of the solution before and after adsorption was determined using UV - VIS spectrophotometer at their corresponding λ max. The effect of surface modifications by oxidation with hydrogen peroxide and ammonium persulphate and degassing at 400 and 650°C of various carbons on adsorption behaviour was also studied. The surface acidity of the carbons was determined by titration with 0.2N sodium hydroxide.

RESULTS AND DISCUSSION

Adsorption isotherms of NB, TNT, PA and SA on five different activated carbons from aqueous solution in the concentration range 20-900 mg/l show that each carbon adsorbs appreciable amounts of the organic compounds. The isotherms are generally type I of the BET classification. The shapes of the isotherms indicate a monolayer adsorption.

The adsorption, although increases with increase in surface area of the carbons, does not appear to be related directly to the surface area.

The influence of surface chemical groups on the adsorption of these nitro compounds was studied by modifying the carbon surface by oxidation which enhances the surface oxide layer and by degassing which eliminates the oxide layer. It is interesting to note from fig.1 that the adsorption increases on oxidation while it decreases on degassing in the case of TNT, PA and SA while the opposite is the case for NB. It appears that in addition to the molecular size of the adsorbates, the nature of the carbon surface is an important factor which influences the adsorption of organic nitro compounds.

The nature of the carbon surface depends upon the type of the carbon surface - oxygen groups. These surface groups have been determined by high temperature desorption studies and by titration with sodium hydroxide. Attempts have been made to relate the adsorption of these nitro-compounds to different types of surface groups.

CONCLUSIONS

The results clearly show that the removal of aromatic nitro compounds from explosive waste waters can be effectively carried out by GAC. Oxidation of GAC has shown pronounced effect on the adsorption of tri-nitro aromatic compounds whereas adsorption of nitrobenzene has been improved significantly by degassed GACs.

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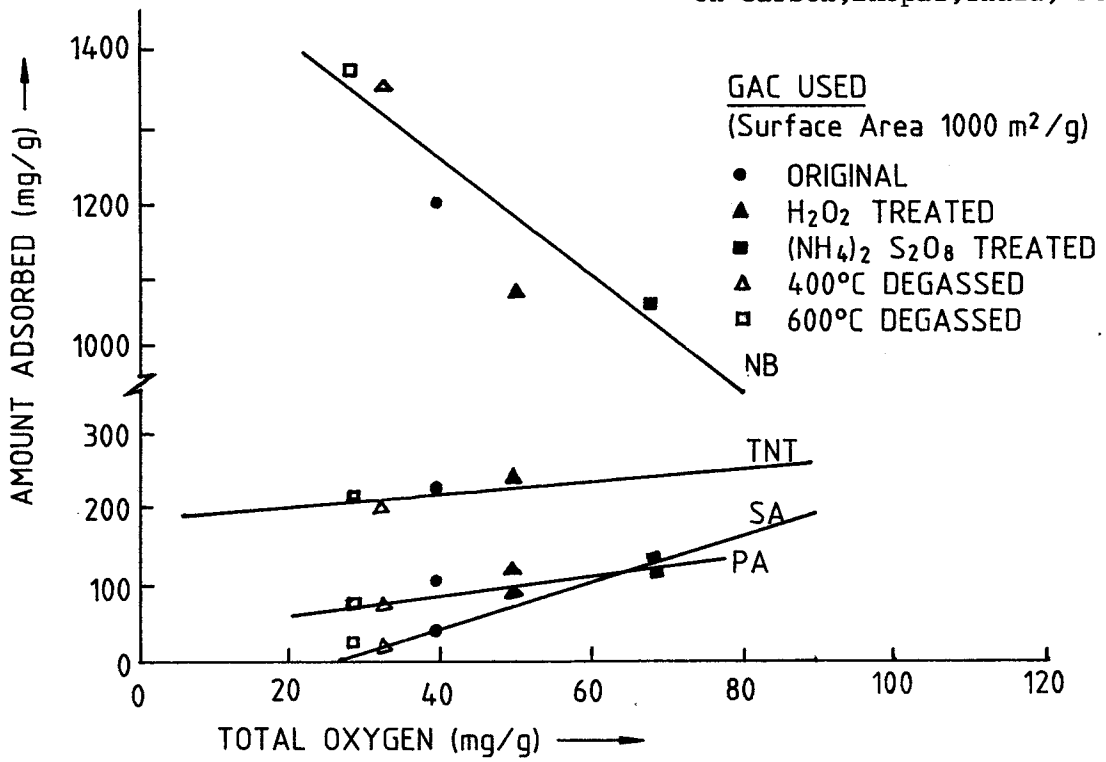

Fig.: 1 : **EFFECT OF TOTAL OXYGEN CONTENT ON ADSORPTION**