

**PRODUCTION OF ACTIVATED PETROLEUM COKE FOR  
WATER TREATMENT FROM THE WASTE OF  
THANLYIN REFINERY PLANT**

**Ph.D. DISSERTATION**

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### **ABSTRACT**

Petroleum coke, by-product from the raw residue of petroleum refinery plant, Thanlyin was collected and activated by the several activation methods such as heat treatment and chemical treatment. In accordance with recommended methods such as the proximate and ultimate analyses, the raw petroleum coke showed the fixed carbon value as 82% , C/H molar ratio as 2:1, C/O molar ratio as 60:1, the percent of C,H,N as 93.54,3.85 and 0.5 respectively and the empirical formula as  $C_{216.5}H_{107}NO_{3.7}$ . The raw petroleum coke containing a high percent of "C" content, was found to be amorphous by XRD pattern.

Sorption studies of activated petroleum coke relevant to the decolorization, deodorization, removal of organic matter ( phenol adsorption ), water softening properties, ion exchange properties and Cu (II) ion metal up-take were also studied. The high sorption capacity of sulphonated petroleum coke ( SPC ) is known from its Langmuir monolayer coverage value  $3.8 \times 10^{-1} \text{ mmol g}^{-1}$  and  $6.0 \times 10^{-3} \text{ mmol g}^{-1}$  for rhodamine B (basic dye) and naphthalene black 12 B (acidic dye). In its dye removal, it is more efficient towards the removal of basic dye.

In addition, to those conventional sorption studies, kinetic studies of SPC with respect to the removal of basic and acidic dye were made with respect to effects of agitation, temperature and concentration. It was found that the sorption with the basic dye obeys the chemisorption where else acidic dye favors physical adsorption.

Of all the activated petroleum cokes, the SPC sample was able to show a high ion exchange capacity,  $2.5 \text{ m.equiv.g}^{-1}$  compared to other activated petroleum cokes as well as high efficient softening power to remove 70% of hardness of raw water bodies. SPC also show a loading capacity for Cu ( II ) ions by the break-through flow method with the loading capacity of  $95.31 \text{ mg g}^{-1}$ .

SPC has the highest ion exchange capacity and macro porous features while the phosphoric acid and sulphuric acid treated petroleum coke ( PSPC ) shows poor efficiency towards organic dyes and ion exchange capacity but exhibits highest phenol sorption property ;  $A_{sp}$  value ( $116.14 \text{ m}^2 \text{ g}^{-1}$ ). PSPC can be interpreted to be more efficient for the organic matter on the context of phenol sorption study.

On the basis of what have been mentioned, activated petroleum cokes have the potentiality to be useful sorbents in water treatment process as well as the possibility of being used as electrode in the electrosorption processes.

***Keywords:*** Sulphonated petroleum coke ( SPC ), break-through flow method