

INFLUENCE OF CARBON SURFACE ON SURFACTANT ADSORPTION BEHAVIOR.

J. Díaz-Terán, D.M. Nevskaja, J.L. G. Fierro*, J. de D. López-González, A. López-Peinado and A. Jerez.

Dpto. Química Inorgánica y Técnica. Fac. Ciencias. Universidad Nacional de Educación a Distancia. C/ Senda del Rey s.n. 28040 Madrid. SPAIN.

*Instituto de Catálisis y Petroleoquímica, CSIC, Campus UAM, Cantoblanco, 28049 Madrid, SPAIN.

Introduction

One of the most usual applications of microporous carbons is in adsorption process [1]. The adsorptive properties of microporous carbons depend on surface area, pore size distribution and surface groups presents.

The impregnation and heat treatment with alkaline metals is a common method for improves the surface properties. The presence of metal and/or oxygen surface groups exerts an important role on surface properties and, therefore, on surfactant adsorption process.

Experimental

Carbons were obtained from esparto-grass, which was impregnated at 3% in weight with aqueous solutions of NaOH, KOH, NaHCO₃ and KHCO₃. They were carbonized under N₂ atmosphere at 673, 873 and 1073 K. The samples were denominated by an E letter followed by the impregnate agent and the temperature of pyrolysis.

XPS spectra were recorded in a Fisons Escalab 200R. The specific surface areas were determined by B.E.T. method in a Micromeritics ASAP 2010 volumetric system.

The surfactant adsorption isotherms were obtained by immersion method at 298 K and concentration changes of dissolution were determined by UV spectroscopy in a Varian Cary 1 Spectrophotometer before and after adsorption on modified carbon.

The surfactant used was anionic type (C₉H₁₉-ph-(OCH₂-CH₂)₁₀SO₄Na⁺).

Results and Discussion

In all impregnated samples the highest adsorption values were obtained in samples carbonized at 1073 K, although some samples develop the highest surface areas at 873 K (Figure 1).

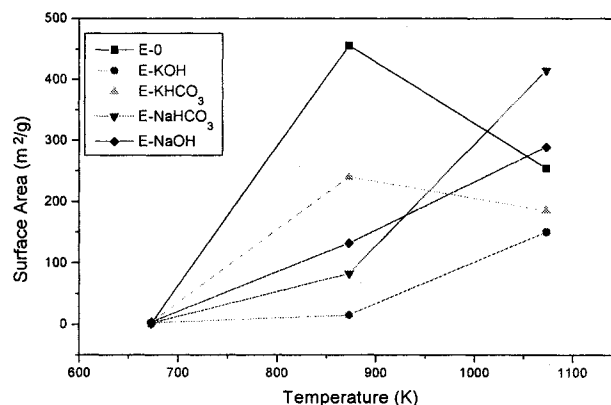


Figure 1. Surface area of carbons vs. carbonization temperature

Moreover, samples impregnated with sodium presented the largest surfactant adsorption, while samples impregnated with potassium had a lower adsorption than non-impregnated samples (figure 2).

Figure 3 shows the surface Metal/Carbon and Oxygen/Carbon ratios of all impregnated samples. It is possible to observe that in all cases the surface metal content increase with pyrolysis temperature, specially in the sample impregnated with KOH and carbonized at 1073 K (E-KOH 1073), where the highest metal distribution was obtained.

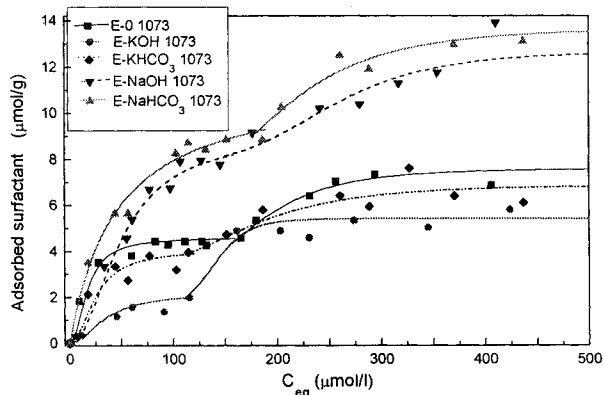


Figure 2. Surfactant adsorption isotherms of samples carbonization at 1073 K

When the impregnate agent used was a hydroxide instead of bicarbonate, a great difference in surface metal content was observed.

The metal hydroxides give rise to higher metal surface distribution than bicarbonates. However, when bicarbonates were used, higher surface areas were obtained [2] and adsorbed more surfactant than hydroxides.

At low temperatures the metal or metal compounds are placed into the carbon pores. When the temperatures increase this compounds (by XPS only oxides and hydroxides were detected) melting and spring out of the pores, as was detected by XPS (figure 3). Furthermore, the surface oxygen amount decreases in E-0 samples (from 0.17 to 0.11 O/C ratio) and in samples impregnated

with potassium, due to surface groups decomposition. By contrary, in sodium impregnated samples the oxygen amount had a soft increase with pyrolysis temperature.

Conclusions

The carbons impregnated with bicarbonates adsorb more surfactant than the samples impregnated with hydroxides.

The carbons impregnated with sodium presented the largest surfactant adsorption. This seems to indicate that sodium acts as active sites for the adsorption of this kind of surfactant.

References

1. R.C. Bansal, J.B. Donnet and F. Stoeckli. Active Carbon. Marcell Dekker. N.Y. 1988
2. J. Díaz-Terán, D.M Nevskaja, J.de D. López-González, A. López-Peinado and A. Jerez. Influencia de la porosidad de un carbón vegetal sobre la adsorción de un surfactante aniónico. Extended abstracts, XXIII Reunión Ibérica de Adsorción. Evora (Portugal). 1998. 109-112.

Acknowledgment

This work has been partially supporter by CICYT (project QUI 97-1271-CO2-01) and by project ITSAFON (project Iberoeka) CYTED 1996.

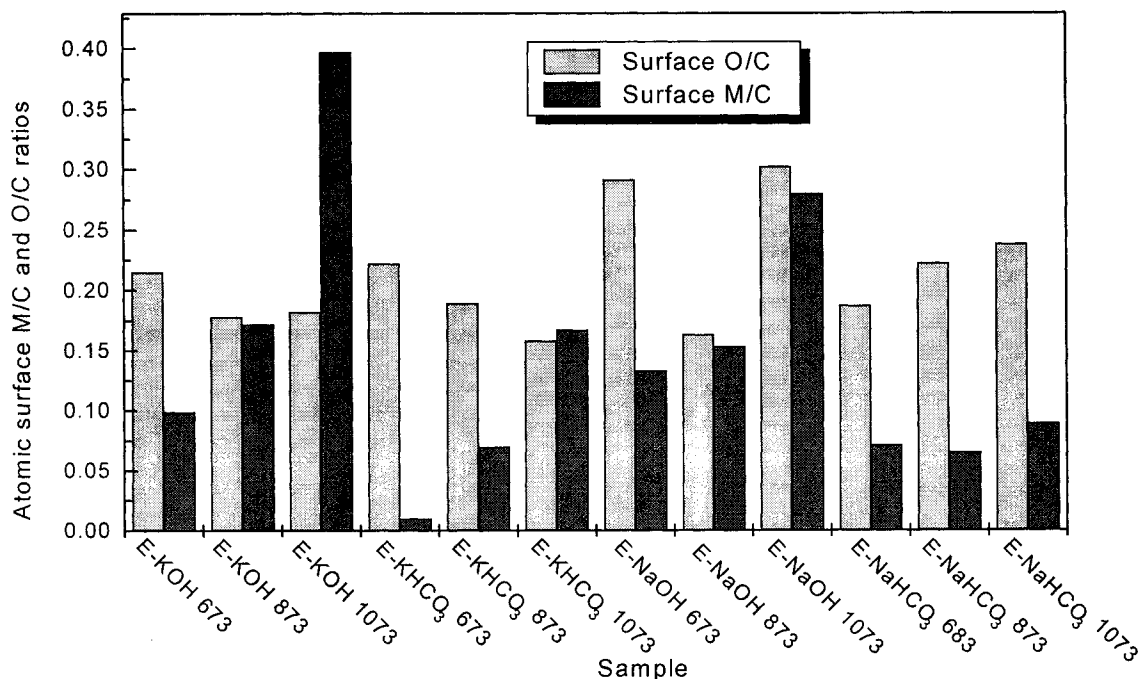


Figure 3. Surface M/C and O/C ratios of carbons (XPS)