

## COMPARATIVE STUDY OF DIFFERENT ORGANIC AND INORGANIC ADSORBENTS FOR THE REMOVAL OF METALS, ORGANIC MATTER AND COLOUR FROM SOLUTION

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### EXTENDED ABSTRACT

A wide range of materials, known for their adsorption properties, have the potential of being used in the purification of drinking and waste waters. These materials range widely in terms of their chemical characteristics, pore structure, adsorption capacity and market price. This paper presents a study where many adsorbents (including activated carbons, bone char, zeolites, ion exchange resins and clays) were characterised and studied for their capacity to remove organic species and metals from solution. Batch and small column adsorption tests have been conducted using synthetic and real waters, respectively.

Results show significant differences between adsorbents of different nature but also between adsorbents of the same type, which is attributed to their specific porosity and surface chemistry. In general, zeolites and ion exchange resins exhibited a very limited capacity to remove organic species from solution but presented high capacities to remove certain metals from solution. On the other hand, the hydrotalcite clay and particularly the bone char exhibited a high adsorption capacity for *both* organic and metal species. The activated carbons exhibited the highest adsorption capacities for organic matter of all materials tested and some of them also adsorbed metals very efficiently.

Nitrogen gas adsorption tests conducted on selected adsorbents do not always show a clear correspondence between surface area and adsorption characteristics. Thus, some zeolites with very high surface areas presented no adsorption capacity for organic matter. It is believed that the polar nature of the surface area in these inorganic materials did not favour interactions with non-polar organic molecules. On the other hand, the low surface area bone char adsorbed organic matter very efficiently, although not as much as some of the most effective activated carbons.

Marked differences in apparent density and market value exist between adsorbent materials, which need to be considered when evaluating their potential for being used in commercial adsorption processes. In particular, the much lower market values of non-conventional inorganic adsorbents, such as natural zeolites and hydrotalcites, compared to the more traditional ones (eg. activated carbon, bone char), provide an incentive for investigating the applicability of these materials in commercial adsorption processes

**Key words:** activated carbon, adsorption, metals, colour, organic matter