# Application of super-expanded graphite for the treatment of soils contaminated with hydrocarbons

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## Abstract

The present work focuses on laboratory investigations addressed to assess the adsorptive properties towards hydrocarbons of a super-expanded graphite. In fact, the possibilities of technological applications of graphene-based materials are derived from some of their peculiar features such as high specific surface area induced by expanding process. Expanded graphite attracted a great interest in oil adsorption from water during the last ten years and super-expanded graphite, with an apparent density less than 2.3 g/l, represents a new generation of such nanomaterial able to provide relevant performances of adsorption, hydrophobic behaviour and stability even at high temperature up to 600°C in air.

All laboratory tests were performed on sandy samples of 100 g characterized by diameters between 0.5 and 2 mm, contaminated by exhausted mineral oil at concentrations of 50, 25 and 12.5 g/kg with an adsorbent/oil ratio of 1:10, 1:20 and 1:40.

Preliminary results relating to the oil removal performance by super expanded graphite have been obtained by the way of two methods: a gravimetric test and analyses of the residual concentrations of hydrocarbon performed following the method ISO 16703/2004 (determination of content of hydrocarbon in the range C10 to C40 by gas chromatography). The results show that the percentage of hydrocarbon removal was about 80%, for the most contaminated samples and for an adsorbent/contaminant ratio of 1:10. The removal efficiencies decrease as both the levels of contamination and the graphene/contaminant dosages reduce. The adsorption capacity, expressed as the mass of pollutant adsorbed per gram of adsorbent, shows a positive trend versus the contact time (Fig. 1).

Overall discussion, the observed performances have been obtained for graphene/oil dosages particularly low and on a matrix (solid) that generates sensitive interference with the sorbent due to the effect of oil adhesion on the surfaces of the treated material. Furthermore, the surface adhesion infers the progressive loss of efficiency due to the decreasing level of contamination allowing the employment of such a technique in case of high contaminant concentrations. Finally, the preliminary results suggest the needed to increase the contact time in order to reach balanced conditions of the adsorption process.

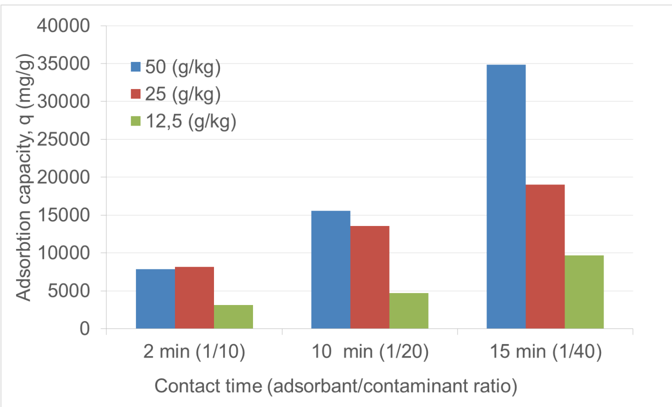


Figure 1 - Effect of contact time, adsorbent/contaminant ratio and initial concentrations on the adsorption capacity of oil, with oil concentrations of: 50 g/kg; 25 g/kg; 12.5 g/kg.