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ABSTRACT BOOK

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Sulfur bearing and aromatic compound trapping by layered silicates: a great start for innovative technological applications

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Sulphur-containing compounds (e.g., hydrogen sulphide and thiols), and monocyclic and polycyclic aromatic molecules (e.g., benzene, naphthalene and their chloro-derivatives) are produced by several industrial and human activities, including food processing, bio-composting, combustion processes of vehicles, etc. In many circumstances their removal is an obliged process in consequence of their toxicity even in low amounts or due to the highly corrosive behaviour. In other conditions, for example when they do not represent a health problem (e.g., thiols), their removal (or decrease) is strongly advised both for their bad smell and for the products they can originate in the medium to long term (e.g., acid rains).

Currently, scientific research at the academic level has been strongly focused on carbon dioxide trapping, leaving other research to industrial labs. As a result, many methods currently used for the removal of these gases (Galadima & Muraza, 2015; Özekmekci et al., 2015) still refer to methodologies developed in the past and, therefore, not completely meeting the modern requirements of the circular economy.

In this work we propose an innovative and efficient method for removing and trapping sulfureted and aromatic molecules using the layer silicate montmorillonite intercalated with the μ-oxo Fe(III) phenanthroline complex (Bernini et al., 2015). The process takes place easily also at room temperature, is reversible, does not require pre-treatment of both gaseous and the adsorbent material, and is efficient also when partial pressures of the target gas is very low. Therefore, even extremely low levels of gasses can be removed easily and quickly through redox reactions (sulfureted compounds) or strong interactions with the aromatic moiety of the iron complex (aromatic molecules). Experimental results, previously planned also applying molecular modeling, were confirmed through chemical analyses, spectroscopic techniques (included synchrotron radiation X-ray absorption spectroscopy), X-ray powder diffraction, and thermal methods.

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