Exploring the effect of biosolid addition on the properties of porous carbonaceous adsorbents

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We have shown previously that even though pyrolyzed biosolids have a relatively low surface area and small pore volume, they are able to adsorb a marked quantity of hydrogen sulfide from moist air. This is owing to the catalytic properties of their surface linked to the high content of alkali earth metals and iron. Although a H_2S capacity is high and reach 10 wt. %, it is still lower than for instance that on Midas catalytic carbon. This is owing to the low pore volume in which sulfur, as an oxidation product, can be stored.

To overcome that deficiency and to expand a biosolid application as a source of adsorbents and catalysts, this research focuses on an increase in the porosity of the adsorbents either by building the composites of biosolid- based materials with carbon and on exploring the role of biosolid as a composite component. As a carbon source, either activated carbon or carbon-rich municipal waste were used. The obtained materials were extensively characterized using various physical and chemical methods and tested as adsorbents of hydrogen sulfide from moist air. It was found that the composition of the adsorbents and pyrolysis conditions affect the porosity of the final adsorbents in quite opposite and unexpected ways. Interestingly, a strong synergistic effect of the biosolid on the performance of the materials as desulfurization media was found.

The novelty of our work is in understanding the role of both composite components in providing that synergistic effect.