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# Techno-economic evaluation of tetravalent manganese feroxyhyte for Hg uptake from flue gases in a fixed-bed adsorption configuration

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**Abstract**

Mercury abatement, especially in coal combustion and waste incineration units, is an important issue in the context of the environmental protection measures. Although the activated carbon injection (ACI) in flue gases is the almost exclusively applied technology, a lot of research is under way to find materials and methods that could replace this technology. In this work, a new oxidizing-adsorbing material, namely tetravalent manganese feroxyhyte (TMFx) exhibiting very high potential Hg uptake capacity, was evaluated for full scale implementation. To this direction, a deep-bed adsorption installation was designed for a typical 100 $MW_e$ coal burning power unit, which was further evaluated economically and compared with a typical ACI system. Capital costs, as well as operating costs, were ten times lower for the newly developed system, i.e. 4.15 and 1.0 million Euros vs. 37.9 and 11.4 in comparison with the ACI. Moreover, power charge was estimated to be 1.6 for the newly proposed system vs. 17.4 mills/kWh for the ACI. Similar differences, around one order of magnitude smaller, were calculated also for the capital cost and for the Hg removal costs. The superiority of deep-bed adsorber with TMFx was also confirmed by comparing relevant indices with those reported in literature. The techno-economic analysis showed that the main advantages of the newly proposed system are the low capital and operating costs, due to the simplicity of the system, the high adsorption capacity of the used material/sorbent and the avoidance of bug filter, as required by the ACI systems.

| **Abbreviation of symbols** | |
|---|---|
| TMFx | Tetravalent manganese feroxyhyte |
| AC | Activated carbon |
| ACI | Activated carbon injection |
| BD | Bed depth, m |
| Bd | Bulk density, 450 kg/$m^3$ |
| BSA | Bed surface area, $m^2$ |