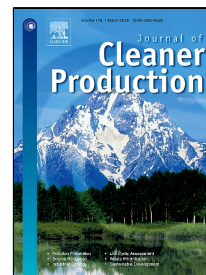


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Multi-objective optimisation of a double contact double absorption sulphuric acid plant for cleaner operation



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1 **Multi-objective optimisation of a double contact double absorption sulphuric acid plant for**  
2 **cleaner operation**

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11  
12 **Abstract**

13 The release of oxides of sulphur (SO<sub>x</sub>) and acid mist (H<sub>2</sub>SO<sub>4</sub>) during the production of sulphuric acid in  
14 the double contact double absorption (DCDA) process is hazardous to the environment. It is a challenging  
15 task to minimise these emissions while keeping plant operation within the production requirements and  
16 maximise revenue. In this study, SO<sub>x</sub> emissions, acid mist emissions, and net revenue are considered as  
17 objectives for multi-objective optimisation (MOO) of the DCDA process. Firstly, the process is modelled  
18 and simulated in Aspen HYSYS, and validated with plant data. MOO is then performed using the elitist  
19 non-dominated sorting genetic algorithm to predict sets of Pareto-optimal operating conditions for  
20 improved environmental and economic performance. The effect of operating parameters such as air flow  
21 rate and pressure, inlet temperatures to catalytic beds and absorbers, demineralised water flow rate, and  
22 boiler feed water flow rate on the process performance is also studied. The results show that the DCDA  
23 process can be operated at different optimal conditions, each of which involves some trade-off among the  
24 objectives of interest. A multi-criteria decision-making technique (known as technique for order of  
25 preference by similarity to ideal solution, TOPSIS) is used to determine the most suitable optimum  
26 operating point. Among the optimal conditions, the chosen solution through TOPSIS has 9.5 ppm of SO<sub>x</sub>

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