

CAT-17: Experimental results and dynamic simulation of enriched air production by water degassing for process intensification

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A new kind of chemical processes intensification can be obtained by the production of enriched air (EA), i.e. an oxygen/nitrogen mixture with an amount of O₂ in the range of 22-35 vol.% from degassing of air saturated water by pressure or temperature action. The basic principle is based on the different Henry's constant of oxygen and nitrogen in water [1]. EA can be directly used in situ, in order to reduce the total flow of combustion air and the volume of the combustion facilities. Alternatively, enriched air can be used for diving or sold for industrial/medical uses [2]. Proper experimental tests were carried out in a laboratory batch plant in order to optimize the two main operative parameters of this operation, i.e. T and P. The obtained experimental data have been elaborated for the modeling of this technology in order to validate the experimental runs and simulate the EA production process obtaining the optimal conditions for the application in different chemical processes. Experimental tests were carried out at $55 < T < 75$ °C and $260 < P < 500$ torr. The elaborated EA model is a non-linear differential-algebraic equations system (DAE), based on two equation sets: the first relates to the degasser while the second refers to the enriched air storage; thus specific numerical tools must be employed in its resolution. Here, BzzMath library is employed for this purpose. In Figure 1 a comparison between experimental data (points) and simulated data (continuous line) is reported at 75°C and 260 torr. From the obtained experimental data is possible to observe that the best condition in term of %O₂ and produced volume of EA is at 260 torr and 75°C because at this couple of T and P all the oxygen dissolved in water is totally degassed. In addition, the dynamic model elaborated shows a good agreement with the achieved experimental data.

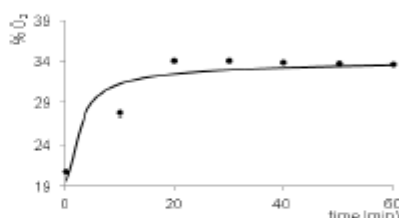


Figure 1: Exp and model results

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References

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