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Production and Application of O2 Enriched Air Produced by Water Desorption in Chemical Plants

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Abstract

The paper proposes the assessment of a new technology in chemical plants for gas mixtures separation, using the enrichment in oxygen of air as appealing case study and proposing its use for new intensifications in industrial chemistry where the advantages using oxygen enriched air (EA) instead of simple air as oxidizing agent are of great potential.

This operation is based on an absorption-desorption process in which the different solubility of incondensable gases in a liquid, water as first, is exploited to perform the enrichment of one compound in the gas mixture. In particular, EA can be obtained by desorption from water, taking advantage of the higher oxygen solubility in water compared to the nitrogen one. Water can be degassed as it is or after a solubilisation tank working under pressure to increase the amount of dissolved gas. When water is in equilibrium with atmospheric air, it contains different amounts of dissolved O_2 and N_2 depending on the temperature and pressure.The idea is to take water in equilibrium with atmosphere at low temperature and to degas it changing T and P conditions. In fact, by increasing the temperature or decreasing the pressure, the content of both N_2 and O_2 in water decreases due to their consequent release into the gas phase. The amount of the so extracted incondensable gases can be collected for several uses rather than venting them in open atmosphere. The main drawback of this application might be the limited amount of oxygen and nitrogen in water and then the high quantity of water required for the great part of chemical process. This problem can be solved by adding a pressurized tank in which water and air are put into contact and then the exiting water, with high amount of dissolved gas due to the pressure action, can be degassed. Depending on the applications and on the amount of EA required, it will be possible to degas water equilibrated with air at room pressure, or under different pressures. Moreover, the same water, after its degassing can be further recycled getting it in contact with new atmospheric air. Positive results have been already experimentally collected and confirmed by simulation, with a continuous production of EA (about 0.4 Nl/h for 30 l/h of water equilibrated at room pressure, with about 30% of oxygen content).The study, optimization and integration of this technology in industrial plant will be presented.