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A short review of CO_2 responsive polymeric adsorbents and membranes for water quality control

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Separation processes using adsorbents and membranes can be regulated by incorporating stimuli-responsive materials. A wide range of polymers demonstrates changes in characteristics and performance reacted to an external stimulus including pH, temperature, gases, or pressure. Among the stimuli, CO_2 is a nontoxic and abundant stimulus that can also be easily added or removed from the separation processes. In this paper, the progress of CO_2 responsive adsorbents and membranes was studied. The tertiary amine or amidine groups of the CO_2-responsive polymers could be easily protonated by CO_2 bubbling, causing characteristic changes to regulate the separation. The synthesis, characteristics, and separation performance were examined. Poly(diethyl-amino-ethyl methacrylate) (PDEAEMA) modified microparticles were used to adsorb protein, but protein recovery remained unclear. The grafting of PDEAAMA and poly(2-(di-methylamino)ethyl methacrylate) (PDMAEMA) on microparticles allowed the adsorption of heavy metals, but higher recovery was attained by PDMAEMA modified microparticles under CO_2 bubbling. The CO_2-responsive polymeric microparticles were successfully applied in forward osmosis, producing water from salt solution without high temperature or pressure. PDEAEMA modified membranes were extensively studied in the separation of oil and water mixture due to their switchable surface hydrophilicity. PDEAEMA and PDMAEMA modified membranes were also tested in nanofiltration since they exhibited changes in pore size and zeta potential to control pollutant rejection. Nevertheless, CO_2-responsive membranes could be cleaned under CO_2/N_2 bubbling.

Topics
Colloids, **Quality assurance**, **Nanofiltration**, **Osmosis**, **Separation processes**, **Surface hydrophilicity**, **Proteins**, **Review**

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