NEW FACILITATED TRANSPORT MEMBRANES FOR CO_2 CAPTURE AND SEPARATION

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We have synthesized new facilitated transport membranes comprising high-molecular-weight polyvinylamine (PVAm) as the fixed site carrier and aminoacid salt (e.g., piperazine glycinate (PG) or lithium glycinate (LG)) as the mobile carrier for facilitated transport of CO_2. PVAm samples with different molecular weights were synthesized through free radical polymerization by adjusting the monomer concentration and initiator amount. The synthesized PVAm showed both a higher molecular weight and a higher solution viscosity than the commercially available PVAm (Lupamin® 9095 from BASF Corporation). The high viscosity of the PVAm solution at a low concentration allowed for the preparation of much thinner membranes. It could also help reducing penetration of the polymer solution into the pores of the substrate, further minimizing the mass transfer resistance. Consequently, a high CO_2 permeance could be obtained from thin membranes with the thicknesses of 100 – 200 nm. The PVAm/PG blend solution was coated onto different substrates including polyethersulfone (PES) and polysulfone (PSf) substrates. Sodium dodecyl sulfate (SDS) surfactant was incorporated in the coating solution to improve the adhesion between the membrane layer and the substrate in some cases. The resultant PVAm/PG membranes exhibited a high CO_2 permeance of about 1100 GPU and a high CO_2/N_2 mixed gas selectivity of more than 140 at the typical flue gas temperature of 57°C along with 17% water vapor, which is the desirable performance for post-combustion CO_2 capture from coal-fired power plants.