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Investigation on a Vertical Radial Flow Adsorber Designed by a Novel Parallel Connection Method☆

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Abstract: Due to the increasing global demand for industrial gas, the development of large-scale cryogenic air separation systems has attracted considerable attention in recent years. Increasing the height of the adsorption bed in a vertical radial flow adsorber used in cryogenic air separation systems may efficiently increase the treatment capacity of the air in the adsorber. However, uniformity of the flow distribution of the air inside the adsorber would be deteriorated using the height-increasing method. In order to reduce the non-uniformity of the flow distribution caused by the excessive height of adsorption bed in a vertical radial flow adsorber, a novel parallel connection method is proposed in the present work. The experimental apparatus is designed and constructed, the Computational Fluid Dynamics (CFD) technique is used to develop a CFD-based model, which is used to analyze the flow distribution, the static pressure drop and the radial velocity in the newly designed adsorber. In addition, the geometric parameters of annular flow channels and the adsorption bed thickness of the upper unit in the parallel-connected vertical radial flow adsorber are optimized, so that the upper and lower adsorption units could be penetrated by air simultaneously. Comparisons are made between the height-increasing method and the parallel connection method with the