Evaluation Shortcut Formula for Adsorbents Used in Pressure Swing Adsorption Processes for CO_2 Capture

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This work suggests a shortcut formula for standardizing the efficiency and purity of a pressure swing adsorption (PSA) process with the aim of CO_2 capture. Existing concept of performance indices of adsorbents, such as working capacity and selectivity, does not represent their practical use in the PSA process. This is due to, in the concept, arbitrary (not optimized) working pressure and the lack of consideration of the consumed energy in the process. As a step towards building a methodology representing those aspects, we present so called a shortcut formula for rough performance evaluation. On the basis of some assumptions, the ratio of the amount of captured CO_2 to the consumed energy is set as the efficiency formula, and the purity formula is defined as the ratio of captured CO_2 to the entire captured gas. The results can be interpreted as theoretically achievable maximum and used as new performance indices for adsorbents. To prove the validity of the formula, a rigorous simulation of the PSA process is carried out and compared. To shorten the gap of the two results, a modification factor is also presented.