ABSTRACT

Global climate change has become a serious issue due to the increasing concentration of greenhouse gases, especially CO_2 emissions that trigger global warming and extreme weather conditions. Carbon Capture and Storage (CCS) technology utilizing adsorption methods with activated carbon presents potential as an economical and environmentally friendly solution. This research aims to develop an activated carbon composite from coconut shell activated with soursop leaf extract and modified with egg white protein to enhance CO_2 adsorption capacity. The research methodology includes extraction and phytochemical analysis of soursop leaves, preparation of activated carbon from coconut shells, synthesis of activated carbon/egg white protein (KA/PT) composites, and CO_2 adsorption testing. Material characterization was carried out using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy–Energy Dispersive X-ray (SEM-EDX), Brunauer–Emmett–Teller (BET), and Particle Size Analyzer (PSA). The results showed that soursop leaf-activated carbon met the Indonesian National Standard (SNI) with water content of 1,05%, ash content of 1,68%, volatile matter of 0,34%, and fixed carbon of 97,98%. FTIR analysis revealed the appearance of new functional groups N-H (3301 cm^{-1}) and C-N (1152 cm^{-1}) derived from egg white protein that indicating successful surface modification of the KA/PT composite. SEM-EDX analysis indicated enlarged pore morphology and the presence of nitrogen 5,76%. BET analysis recorded an increase in surface area up to 232,56 m^2/g after activation with soursop leaf extract. PSA results showed that the composite particle size was in the microparticle range with an average of 691 nm. CO_2 adsorption tests demonstrated that the KA/PT composite powder with a 1:1 ratio showed optimal performance with an adsorption percentage of 68,36% and adsorption capacity of 5,4353 mmol/g. This research successfully demonstrated the effectiveness of combining activated carbon with egg white protein in enhancing CO_2 adsorption while supporting green chemistry concepts through the utilization of sustainable organic waste.

***Keyword**: activated carbon, egg white protein, composite, CO_2 adsorption*