

## OPE2) Green Synthesis of Noble Nanoparticles from *Sargassum serratifolium* Extract for Catalytic Reduction of Synthetic Dyes

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### 1. 서론

These days, discharge of hazardous dyes from many industries in water has become a significant environmental issue, which increases water pollution seriously. Hence, it is significantly desirable to develop an eco-friendly method for degradation of synthetic dyes in water. *Sargassum serratifolium* (SS), a brown algae, extract was used as the reducing, capping, and stabilizing agent for green-synthesis of silver and gold nanoparticles. We developed SS extract-capped silver and gold nanoparticles (SS-AgNPs and SS-AuNPs) and investigated their antibacterial against human pathogenic bacteria and catalytic properties in a degradation of methylene blue, rhodamine B, and methyl orange for environmental remediation.

### 2. 재료 및 방법

*Sargassum serratifolium* extract was obtained from JEJU Technopark Inc. (Jeju, KR). For green-synthesis, 1  $\mu$ L of aqueous  $\text{AgNO}_3$  or  $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$  (1 M) solution was put into the filtered extract of 1mL SS (2 mg/ml) and incubated in water for 15 min at 80°C. After 15 min, a tube that contains AgNPs or AuNPs was put in ices for 5 min. Agar disk diffusion method was employed to investigate antibacterial activity. *Staphylococcus aureus* (ATCC 25923, *S. aureus*), *Bacillus subtilis* (ATCC 10783, *B. subtilis*) and *Escherichia coli* (ATCC 25922, *E. coli*) were obtained from the American Type Culture Collection (Rockville, MD, United States). The catalytic potential for reduction of dyes was studied using the UV-Visible spectrophotometer with ice cold  $\text{NaBH}_4$ .

### 3. 결과 및 고찰

SS-AgNPs and SS-AuNPs displayed maximum absorption at 435 and 530 nm in ultraviolet-visible spectroscopy, respectively. Dynamic light scattering assessment revealed that diameters of SS-AgNPs and SS-AuNPs were  $120.0 \pm 3.85$  and  $17.47 \pm 0.13$  nm, with zeta potential values of  $-34.3 \pm 0.47$  and  $-31.9 \pm 0.75$  mV, respectively. High resolution-transmission electron microscopy confirmed the spherical shape and crystalline structure of the NPs in optimal conditions was determined as face centered cubic (fcc) by X-ray powder diffraction. The presence of elemental silver and gold were confirmed by energy-dispersive X-ray spectroscopy. Fourier transform-infrared spectroscopy confirmed SS extracts' role as a reducing and capping agent by comparing bands observed. Antibacterial activities noted that only SS-AgNPs have inhibition zones against two gram-positive strains (*S. aureus* and *B. subtilis*) and a gram-negative strain (*E. coli*). Methylene blue, rhodamine B, and methyl orange were degraded completely with the presence of  $\text{NaBH}_4$  in the study of catalytic activities of the prepared nanoparticles. The reduction of organic dyes followed the pseudo-first order kinetics.

### 4. 참고문헌

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