



The Syntheses of Chromium Aluminum Carbide (Cr_2AlC) MAX Phase and Cr_2CT_x MXene and Investigation of Their Antimicrobial Properties

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Abstract

Chromium aluminum carbide (Cr_2AlC) MAX phase and Cr_2CT_x (MXene-Cr) were synthesized by the pressureless sintering method and hydrothermal method, respectively. In addition to this, the free radical scavenging activities (FRSA) of MAX-Cr phase and MXene-Cr compounds were tested and compared with ascorbic acid and trolox as standard compounds. The obtained FRSA results of MAX-Cr phase and MXene-Cr were 42.82 and 59.64%, respectively, at 100 mg/L concentration. MXene-Cr showed a 66.90% inhibitory effect on α -amylase at 200 mg/L. The DNA nuclease activity of compounds was determined to be extremely satisfactory at 50, 100, and 200 mg/L concentrations. Moreover, the prepared MAX-Cr phase and MXene-Cr were investigated for antimicrobial activity against six bacterial and two fungal strains by the broth microdilution method. Compounds provided more significant inhibition against Gram-positive bacteria than Gram-negative bacteria and fungi. MAX-Cr phase and MXene-Cr almost completely inhibited microbial cell viability at a 25 mg/L concentration. Additionally, MXene-Cr showed 89.86% and 87.01% antibiofilm activity against *S. aureus* and *P. aeruginosa*, respectively, while the antibiofilm activity of the MAX-Cr phase was over 90%.

Keywords Cr_2AlC MAX phase (MAX-Cr) · Cr_2CT_x (MXene-Cr) · Antioxidant · Antimicrobial · DNA cleavage · Biofilm inhibition

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