# Analysis of Phytochemical Content and Bioactive Properties of *Kappaphycus alvarezii* Methanolic Extract

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Seaweeds are one of the important living resources of the marine environment. *Kappaphycus alvarezii*, a marine red seaweed, is primarily grown in Sri Lanka and has been reported to contain valuable bioactive compounds; however, its importance remains unknown. The bioactive properties, including antioxidant, antidiabetic, anti-inflammatory, and antibacterial activities of 70% methanolic extract of *K. alvarezii* were investigated using an *in vitro* method. *K. alvarezii* powder was extracted using 70% methanol (1:10) and freeze-dried. The yield of the methanolic extract was 22.16 ± 0.49%. Total phenolic and flavonoid contents were 0.99 ± 0.03 mg gallic acid equivalents/g of extract and 0.40 ± 0.06 mg rutin equivalents/g of extract, respectively. The crude extract showed antioxidant activities, including 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity ($IC_{50}$: 10.48 ± 0.22 mg/mL), total antioxidant (3.16 ± 0.06 mg ascorbic acid equivalents/g extract), reducing ability (1.67 ± 0.02 mg ascorbic acid equivalents/g extract), and $H_2O_2$ scavenging activity ($IC_{50}$:2.06 ± 0.07 mg/mL). The antidiabetic potential was assessed by inhibiting alpha-amylase activity, with an $IC_{50}$ value of 16.40 ± 0.72 mg/mL. Antioxidant and antidiabetic activities increased significantly with increasing concentration, indicating a dose-dependent response. It showed anti-inflammatory activities, including inhibition of bovine serum albumin denaturation (50.00 ± 3.72%), trypsin inhibition (24.33 ± 0.84%), and heat-induced haemolysis (22.62 ± 1.09%) at 1 mg/mL and antimicrobial potential with inhibition zones at 250 mg/mL and 500 mg/mL concentration against *Staphylococcus aureus* (8.50 ± 0.71 mm and 10.50 ± 0.71 mm), *Bacillus subtilis* (10.50 ± 0.71 mm and 13.50 ± 0.71 mm), and *Escherichia coli* (8.50 ± 0.35 mm and 11.25 ± 0.35 mm), respectively. However, no activity against *Salmonella enterica*. Results demonstrated that methanolic *K. alvarezii* extract could be used as a potential source of bioactivity and may have great importance as a therapeutic agent in the food and pharmaceutical industries.

**Keywords:** Antioxidant, Antidiabetic, Antimicrobial, *K. alvarezii*, Phenolics, Seaweed