

**ANALISIS MULTIVARIAT GC-MS, TOTAL FENOLIK, FLAVONOID,
DAN AKTIVITAS ANTIOKSIDAN KULIT TIGA SPESIES JERUK
MENGUNAKAN *PRINCIPAL COMPONENT ANALYSIS***

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INTISARI

Penelitian ini dilakukan untuk mengetahui senyawa metabolit sekunder dan aktivitas antioksidan berbagai metode pada kulit tiga spesies jeruk. Selain itu, juga untuk mengevaluasi pengaruh senyawa metabolit sekunder terhadap aktivitas antioksidan. Penelitian diawali dengan preparasi dan ekstraksi kulit jeruk. Hasil ekstrak kemudian dilakukan pengujian *total phenolic content* (TPC), *total flavonoid content* (TFC), dan antioksidan (DPPH, ABTS, dan FRAP). Selain itu, juga dilakukan karakterisasi sampel menggunakan instrumen FTIR dan GC-MS. Data hasil pengujian kemudian dianalisis statistik.

Berdasarkan hasil penelitian, diperoleh hasil TPC pada kulit jeruk limau, nipis, dan santang berturut-turut $20,93 \pm 1,70$; $15,16 \pm 1,47$; dan $12,91 \pm 0,34$ mg GAE/g, sedangkan TFC berturut-turut yaitu $12,02 \pm 0,62$; $6,04 \pm 0,24$; dan $3,31 \pm 0,20$ mg QE/g. Aktivitas antioksidan metode DPPH dalam IC_{50} pada kulit jeruk limau, nipis, dan santang yaitu $189,87 \pm 9,89$; $1232,33 \pm 28,0$; dan $570,10 \pm 17,64$ ppm. Aktivitas ABTS ekuivalen trolox yaitu $45,43 \pm 0,16$; $41,45 \pm 0,96$; dan $45,00 \pm 0,51$ mg TEAC/g. Aktivitas FRAP sebesar $97,36 \pm 12,74$; $40,10 \pm 1,80$; dan $37,91 \pm 1,51$ mg TEAC/g. Hasil data kemudian diolah statistik dengan Anova dan diperoleh angka signifikansi $p < 0,05$. Kumpulan hasil data dapat diinterpretasikan menggunakan dua *Principle Component* (PC) pada PCA dengan total PC 92,3 % dan diperoleh hasil senyawa yang paling berpengaruh pada antioksidan selain TPC dan TFC yaitu α -Sinensal, Citronellol, dan (R)-(+)-citronellal.

Kata kunci: kulit jeruk, senyawa metabolit sekunder, antioksidan, *principal component analysis*

MULTIVARIATE ANALYSIS OF GC-MS, TOTAL PHENOLIC, FLAVONOID, AND ANTIOXIDANT ACTIVITIES IN THE PEELS OF THREE CITRUS SPECIES USING PRINCIPAL COMPONENT ANALYSIS

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ABSTRACT

This study was conducted to determine secondary metabolite compounds and antioxidant activities using various methods in the peels of three citrus species. In addition, it also aimed to evaluate the effect of secondary metabolite compounds on antioxidant activities. The study began with the preparation and extraction of citrus peels. The resulting extracts were tested for Total Phenolic Content (TPC), Total Flavonoid Content (TFC), and antioxidant activities using DPPH, ABTS, and FRAP assays. Furthermore, sample characterization was performed using FTIR and GC-MS instruments. The resulting data were then statistically analyzed.

Based on the research findings, the TPC values of *Citrus amblycarpa*, *Citrus aurantifolia*, and *Citrus reticulata* peels were 20.93 ± 1.70 ; 15.16 ± 1.47 ; and 12.91 ± 0.34 mg GAE/g, respectively, while the TFC values were 12.02 ± 0.62 ; 6.04 ± 0.24 ; and 3.31 ± 0.20 mg QE/g, respectively. The antioxidant activity determined by the DPPH method in terms of IC_{50} was 189.87 ± 9.89 ; 1232.33 ± 28.0 ; and 570.10 ± 17.6 ppm, respectively. The ABTS activity expressed as trolox equivalent was 45.43 ± 0.16 ; 41.45 ± 0.96 ; and 45.00 ± 0.51 mg TEAC/g, while FRAP activity was 97.36 ± 12.74 ; 40.10 ± 1.80 ; and 37.91 ± 1.51 mg TEAC/g, respectively. Statistical analysis using ANOVA revealed significant differences among samples ($p < 0.05$). The dataset was further interpreted using two Principle Components (PC) in PCA, accounting for a total variance of 92.3 %. The compounds found to have the most influence on antioxidant activities besides TPC and TFC were α -Sinensal, Citronellol, and (R)-(+)-citronellal.

Keywords: citrus peels, secondary metabolite compounds, antioxidants, principal component analysis