

**SINTESIS NANOPARTIKEL PERAK TERTUDUNG  
POLIVINILPIROLIDON (AgNPs-PVP) DAN APLIKASINYA SEBAGAI  
SENSOR PADA DETEKSI KROMIUM(VI) SECARA KOLORIMETRI  
BERBASIS GAMBAR DIGITAL**

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**INTISARI**

Nanopartikel perak tertudung polivinilpirolidon (AgNPs-PVP) telah disintesis dari ion  $\text{Ag}^+$  menggunakan bantuan gelombang mikro dengan asam askorbat sebagai pereduksi dan polivinilpirolidon (PVP) sebagai penudung. AgNPs yang telah diperoleh dimanfaatkan sebagai detektor Cr(VI) secara kolorimetri berbasis analisis komponen warna digital (RGB). Proses sintesis diawali dengan optimasi berbagai parameter, yaitu konsentrasi asam askorbat, optimasi daya gelombang mikro, volume NaOH, konsentrasi PVP, konsentrasi  $\text{AgNO}_3$ , dan waktu iradiasi. Hasil sintesis ditandai dengan koloid berwarna kuning, sedangkan penambahan Cr(VI) menyebabkan agregasi AgNPs-PVP yang terlihat dari perubahan warna menjadi jingga. Karakterisasi menggunakan FTIR, XRD, dan TEM mengonfirmasi keberhasilan pembentukan AgNPs-PVP.

Validasi metode menunjukkan bahwa kolorimetri berbasis citra digital memiliki selektivitas yang baik terhadap Cr(VI) dengan LoD  $8,97 \mu\text{M}$  dan LoQ  $27,20 \mu\text{M}$ , meskipun sensitivitasnya lebih rendah dibandingkan spektrofotometri UV-Vis (LoD  $1,60 \mu\text{M}$ ; LoQ  $4,85 \mu\text{M}$ ). Dengan demikian, AgNPs-PVP berpotensi digunakan sebagai sensor kolorimetri Cr(VI), walaupun akurasi masih perlu ditingkatkan dibandingkan metode spektrofotometri.

Kata kunci: AgNPs, asam askorbat, PVP, DIC, dan sensor Cr(VI).

***SYNTHESIS OF POLYVINYLPIRROLIDONE-CAPPED SILVER NANOPARTICLES (AgNPs-PVP) AND THEIR APPLICATION AS A COLORIMETRIC SENSOR FOR CHROMIUM(VI) DETECTION VIA DIGITAL IMAGE-BASED COLORIMETRY***

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**ABSTRACT**

Polyvinylpyrrolidone-capped silver nanoparticles (AgNPs-PVP) were synthesized from  $\text{Ag}^+$  ion using microwaves irradiation, with ascorbic acid as the reducing agent and polyvinylpyrrolidone (PVP) as the stabilizer. The resulting AgNPs-PVP were employed as a colorimetric sensor for Cr(VI) detection based on digital image analysis of RGB color components. The synthesis process was optimised by varying several parameters, including ascorbic acid concentration, microwave power, NaOH volume, PVP concentration,  $\text{AgNO}_3$  concentration, and irradiation time. The formation of AgNPs-PVP was indicated by a yellow-colored colloid, while the addition of Cr(VI) induced aggregation, resulting in color change from yellow to orange. Characterization using FTIR, XRD, and TEM confirmed the successful formation of AgNPs-PVP.

Method validation revealed that digital image colorimetric method exhibited good selectivity towards Cr(VI) with a limit of detection (LoD) of 8.97  $\mu\text{M}$  and a limit of quantification (LoQ) of 27.20  $\mu\text{M}$ . However its sensitivity was lower than that of UV-Vis spectrophotometric, which showed LoD and LoQ values of 1.60  $\mu\text{M}$  and 4.85  $\mu\text{M}$ , respectively. These finding suggest that PVP-stabilized AgNPs-PVP have potential as a colorimetric sensor for Cr(VI), although improvements are still needed to achieve accuracy comparable to UV-Vis spectrophotometry.

Keywords: AgNPs, ascorbic acid, Cr(VI) sensor, PVP, and digital image colorimetry