PENENTUAN RHODAMIN B DAN *METANIL YELLOW* SECARA VOLTAMETRI SIKLIK MENGGUNAKAN *SCREEN PRINTED CARBON ELECTRODE* (SPCE) TERMODIFIKASI *REDUCED GRAPHENE OXIDE* (rGO) DAN NANOPARTIKEL PERAK (AgNPs)

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INTISARI

Modifikasi elektroda menggunakan material dengan konduktivitas tinggi dan luas permukaan besar dapat meningkatkan kepekaan dalam analisis senyawa tertentu. Pada penelitian ini, *reduced graphene oxide* (rGO) dan nanopartikel perak (AgNPs) dikombinasikan untuk memodifikasi elektroda *Screen Printed Carbon Electrode* (SPCE), dan selanjutnya digunakan untuk penentuan pewarna sintetik Rhodamin B dan *metanil yellow* secara voltametri siklik. Penelitian diawali dengan sintesis *graphene oxide* (GO) melalui proses oksidasi grafit menggunakan kalium permanganat. Padatan GO selanjutnya direduksi menggunakan asam askorbat menghasilkan rGO. Sintesis nanopartikel perak (AgNPs) dilakukan dengan mereduksi perak nitrat menggunakan trinatrium sitrat. Karakterisasi rGO dilakukan menggunakan spektrofotometri UV-Vis, ATR-IR, XRD, SEM dan TEM. Karakterisasi AgNPs dilakukan dengan spektrofotometri UV-Vis dan TEM.

Analisis voltametri siklik diawali dengan aktivasi SPCE menggunakan NaOH 0,1 N yang dilewatkan potensial 0–1,2 V dengan laju pindai 0,1 V/detik sebanyak 10x *scan*. Optimasi laju pindai dilakukan pada rentang 10–100 mV/detik dan diperoleh optimum pada 30 mV/detik. Modifikasi elektroda dilakukan dengan teknik *drop-casting.* Kajian pengaruh konsentrasi rGO-AgNPs pada modifikasi elektroda untuk penentuan Rhodamin B dan *metanil yellow* dilakukan pada konsentrasi 0,2–1,4 mg rGO dalam 1 mL AgNPs. Hasil optimum diperoleh pada konsentrasi 0,6 mg/mL. Kajian pengaruh variasi laju pindai juga diamati pada rentang 10–100 mV/detik. Karakterisasi SPCE termodifikasi (SPCE-rGO/AgNPs) menggunakan SEM-EDX untuk mengetahui morfologi dan komposisi unsur di permukaan elektroda. Rentang linear penentuan Rhodamin B diperoleh pada 6–100 µM dan *metanil yellow* pada 40–400 µM, dengan batas deteksi 3,66 µM untuk Rhodamin B dan 14,86 µM untuk *metanil yellow*. Uji presisi dan *recovery* dilakukan menggunakan sampel arum manis dan bolu emprit. Data presisi memberikan hasil yang baik dengan RSD < 2%, sementara *recovery* diperoleh > 80% untuk Rhodamin B dan > 70% untuk *metanil yellow*. Metode selektif terhadap senyawa interferensi sukrosa, soda kue, MSG, kurkumin dan tepung jagung, ditunjukkan dengan nilai RSD < 8%.

Kata kunci: Rhodamin B, *metanil yellow*, *reduced graphene oxide*, nanopartikel perak, SPCE

CYCLIC VOLTAMMETRIC DETERMINATION OF RHODAMINE B AND METANIL YELLOW USING REDUCED GRAPHENE OXIDE (rGO) AND SILVER NANOPARTICLES (AgNPs) MODIFIED SCREEN PRINTED CARBON ELECTRODE (SPCE)

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ABSTRACT

Electrode modification using materials with high conductivity and large surface area can enhance sensitivity in the analysis of certain compounds. In this study, reduced graphene oxide (rGO) and silver nanoparticles (AgNPs) were combined to modify the Screen Printed Carbon Electrode (SPCE) electrode, and were further used for the cyclic voltammetric determination of synthetic dyes Rhodamine B and metanil yellow. The research began with the synthesis of graphene oxide (GO) through the oxidation process of graphite using potassium permanganate. GO solids are subsequently reduced using trisodium citrate to produce rGO. Silver nanoparticles (AgNPs) are synthesized by reducing silver nitrate using ascorbic acid. Characterization of rGO was carried out using UV-Vis spectrophotometry, ATR-IR, XRD, SEM and TEM, while AgNPs characterized using UV-Vis spectrophotometry and TEM.

The measurement of cyclic voltammetry begins with SPCE activation using 0.1 N NaOH which is passed through a potential of 0–1.2 V with a scan rate of 0.1 V/second for 10x scans. Scan rate optimization was carried out in the range of 10–100 mV/sec and obtained optimum at 30 mV/sec. Electrode modification was done by drop-casting technique. The study of the effect of rGO-AgNPs composition on electrode modification for the determination of Rhodamine B and metanil yellow was carried out on the concentration of 0.2–1.4 mg rGO in 1 mL AgNPs. Optimum results were obtained at a concentration of 0.6 mg/mL. Study of the effect of scan rate variation was also observed in the range of 10–100 mV/sec. Modified SPCE (SPCE-rGO/AgNPs) characterized using SEM-EDX to determine the morphology and elemental composition on the electrode surface. The linear range of Rhodamine B measurement was obtained at 6–100 μM and metanil yellow at 40–400 μM, with a limit of detection 3.66 μM for Rhodamine B and 14.86 μM for metanil yellow. Precision and accuracy tests were conducted using cotton candy and sponge cake samples. Data precision yielded good results with RSD < 2%, while recovery was obtained > 80% for Rhodamine B and > 70% for metanil yellow. The method was selective against interfering compounds sucrose, baking soda, MSG, curcumin and corn starch, indicated by RSD values < 8%.

Keywords: Rhodamine B, metanil yellow, reduced graphene oxide, silver nanoparticle, SPCE