

**PENGEMBANGAN PRAKTIKUM DARING REAKSI SUBSTITUSI BERBASIS
GREEN CHEMISTRY UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR
KREATIF DAN GENERIK SAINS CALON GURU KIMIA**

DISERTASI

Diajukan untuk Memenuhi Sebagian dari
Syarat untuk Memperoleh Gelar Doktor Pendidikan IPA



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FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
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Pengembangan Praktikum Daring Reaksi Substitusi Berbasis *Green Chemistry* Untuk Meningkatkan Keterampilan Berpikir Kreatif Dan Generik Sains Calon Guru Kimia

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Sebuah Disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Doktor Pendidikan (Dr.) pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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Penulis sangat menyadari bahwa karya tulis ini masih jauh dari sempurna baik secara penyajian maupun substansi yang diungkapkan. Penulis menyadari dengan keterbatasan ilmu yang dimiliki, sehingga karya ini belum memuaskan. Karena itu, kritik dan saran yang bersifat konstruktif sangat diharapkan agar karya ini dapat berguna bagi dunia pendidikan, khususnya pendidikan kimia agar mutu pendidikan kimia menjadi lebih baik lagi, insyaAllah. Amin.

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Abstrak

Penelitian ini bertujuan mengembangkan praktikum daring reaksi substitusi senyawa organik berbasis *green chemistry*, untuk meningkatkan keterampilan berpikir kreatif dan generik sains mahasiswa calon guru kimia. Penelitian menggunakan metode campuran, dengan model *embedded experiment*. Tahapan penelitian meliputi uji coba prosedur praktikum di laboratorium kimia organik dan produk dianalisis dengan GC-MS; pembuatan video praktikum dalam tiga bagian yang diunggah ke media *Youtube*; dan implementasi desain praktikum menggunakan media *zoom meeting* sebanyak empat kali pertemuan. Dua pertemuan pertama mahasiswa merancang desain praktikum, dan dua pertemuan berikutnya mahasiswa menganalisis video praktikum. Jumlah subjek penelitian pada uji coba sebanyak 21 mahasiswa dan pada implementasi sebanyak 34 mahasiswa calon guru semester tiga yang sedang menempuh perkuliahan praktikum kimia organik, pada salah satu perguruan tinggi negeri di Kota Semarang. Data penelitian dianalisis secara kuantitatif dengan model Rasch, dan secara kualitatif dengan analisis fenomenologi. Ditemukan, karakteristik praktikum reaksi substitusi senyawa organik berbasis *green chemistry* menggunakan bahan mentol dengan pereaksi *Lucas*. Hasil GC-MS menunjukkan jumlah mentil klorida yang dihasilkan 56,63%. Secara kreatif mahasiswa dapat merancang kegiatan praktikum, dari reaksi, ekstraksi, sampai identifikasi senyawa mentil klorida. Implementasi desain praktikum memberikan pengaruh yang signifikan meningkatkan pemahaman mahasiswa pada konsep reaksi substitusi, dibuktikan dengan uji-t berpasangan sebesar $0,00 < \alpha (0,05)$. Pemahaman konsep mahasiswa mengalami peningkatan pada penentuan struktur senyawa pereaksi berdasarkan produk, mekanisme pergerakan elektron, penentuan posisi gugus hidroksil pada senyawa alkohol, identifikasi produk substitusi berdasarkan temuan praktikum, mekanisme pergerakan elektron, dan membedakan mekanisme reaksi (S_N1 dan S_N2).

Abstract

This study aims to develop an online experiment of organic compound substitution reactions based on green chemistry, to improve creative thinking skills and generic science of chemistry teacher candidates. The research uses mixed methods, with an embedded experiment model. The research includes experimental procedures and the products are analyzed by GC-MS; making a video in three parts uploaded to Youtube; and implementation of the experimental design using zoom meeting. In the first two meetings, students designed the experimental, and in the next two meetings, students analyzed the experimental video. The number of research subjects in the trial was 21 students and 34 students in the implementation, who were taking organic chemistry experiment courses, at the universities in Semarang city. The data were analyzed quantitatively with the Rasch model, and qualitatively with phenomenological analysis. It was found, the characteristics of the substitution reaction for organic compounds based on green chemistry using menthol with Lucas reagent. GC-MS results showed menthyl chloride produced was 56.63%. Creatively students can design experimental, from reactions, extraction, to identification of menthyl chloride compounds. The implementation of the experimental design has a significant effect on increasing students' understanding of the concept of substitution reactions, as evidenced by the paired t-test of $0.00 < \alpha (0.05)$. Understanding of student concepts has increased in determining the structure of reactant compounds based on products, electron movement mechanisms, determining the position of hydroxyl groups, identification of substitution products based on experimental findings, electron movement mechanisms, and differentiating SN_1 and SN_2 .

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