

SYNTHESIS OF ZINC-DIFATTYALKYLDITHIOCARBAMATES AND THEIR ANTIOXIDANT ACTIVITIES

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ABSTRACT

Zinc-difattyalkyldithiocarbamates are organosulfur compounds with many functions, including as an antioxidant in a lubrication system. They were synthesized by reacting secondary fatty amine with $ZnCl_2$ and CS_2 giving result zinc-difattyalkyldithiocarbamates of around 77-87%. The synthesized products were characterized using infrared (IR) spectroscopic techniques. The IR spectra of zinc-difattyalkyldithiocarbamates showed sharp bands at $1450-1550\text{ cm}^{-1}$ for thioureida ν (C-N), $950-1050\text{ cm}^{-1}$ for ν (C-S), and in the far-red area $300-400\text{ cm}^{-1}$ for sulfur-metal bond. Products recovery was evaluated by AAS and the purity was analyzed by HPLC. Seven variants of zinc-difattyalkyldithiocarbamates were obtained. Antioxidant activity was evaluated by rancimat test regarding their induction time. At 125 ppm levels all variants showed higher value in each of their induction time as compared to those of butylated hydroxyanisole and butylated hydroxytoluene, commercial antioxidants No.1, and commercial antioxidants no.2. Three variants, i.e. Zn-bis(dilauryl)dithiocarbamate, Zn-bis(laurylpalmityl)dithiocarbamate, and Zn-bis(laurylstearyl)dithiocarbamate had higher values in their induction time than the other variants. The values are 16.67, 26.54, and 16.11 h, respectively.

Keywords: antioxidants; dithiocarbamate complex; Zn-difattyalkyldithiocarbamate

ABSTRAK

Zn-difattyalkyldithiocarbamates merupakan senyawa organosulfur yang memiliki banyak fungsi, termasuk sebagai antioksidan dalam sistem pelumasan. Zn-difattyalkyldithiocarbamates disintesis dengan mereaksikan antara fattyamin sekunder dengan $ZnCl_2$ dan CS_2 yang memberikan hasil sekitar 77-87%. Hasil sintesis ini dikarakterisasi dengan teknik spektroskopi infra merah. Spektrum infra merah dari Zn-difattyalkyldithiocarbamates menunjukkan serapan tajam pada $1450-1550\text{ cm}^{-1}$ untuk thioureida ν (CN), $950-1050\text{ cm}^{-1}$ ν (CS), dan di daerah infra merah jauh pada $300-400\text{ cm}^{-1}$ untuk ikatan sulfur logam. Perolehan kembali produk dievaluasi dengan AAS dan kemurniannya dengan HPLC. Tujuh variasi Zn-difattyalkyldithiocarbamates diperoleh. Aktivitas antioksidan dievaluasi dengan uji rancimat yang mengukur waktu induksi dari produk. Pada tingkat konsentrasi 125 ppm semua varian menunjukkan hasil yang lebih tinggi dari butylated hydroxyanisole (BHA) dan Butylated hydroxytoluene (BHT), antioksidan komersial 1 dan antioksidan komersial 2. Tiga varian, yaitu Zn-bis(dilauryl)dithiocarbamate, Zn-bis(laurylpalmityl)dithiocarbamate, dan Zn-bis(laurylstearyl)dithiocarbamate memiliki nilai waktu induksi yang lebih tinggi dibanding varian lainnya. Nilai dari variasi tersebut, yaitu 16,67; 26,54; dan 16,11 jam.

Kata Kunci: antioksidan; kompleks ditiokarbamat; Zn-difattyalkyldithiocarbamate

INTRODUCTION

Currently, all lubricants contain at least one antioxidant agent for stabilization and other performance-enhancing purposes. Since oxidation has been identified as a major cause of loss of lubricant quality, it is important to improve the stability. The oxidation processes result in a variety of harmful species of chemicals which eventually reduces the lubrication function and shortens life service of the lubricant.

Oxidation process initiated by hydrocarbon exposure to both oxygen and heat. The processes can be greatly accelerated by transitional metals such as copper, iron, and nickel [1]. Dithiocarbamates are organosulfur compounds which easily form complexes with metal ions, and if they are in the form of coordination with a metal, they will have wide variety functions and applications. The applications of these compounds are in the field of automotive as additives in lubricants, as insecticides and fungicides in agriculture, as an acceleration of vulcanization in the

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