

ABSTRACT

SYNTHESIS OF ISONITRILE COMPOUNDS (GLU-OiPR-OBZ₃ AND GLU-OiPR-OCT₃) AS NEW ANTI FOULING AGENTS BASED ON D-GLUCOSAMINE

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Two new antifouling agents that are Glu-OiPr-Obz₃ (isonitrile **31**) and Glu-OiPr-Oct₃ (isonitrile **33**) have been synthesized from D-glucosamine and their antifouling activities have been examined. The compounds of isonitrile **31** and **33** were achieved by simple synthesis pathway (7 step of reactions) which produced 5 important intermediate compounds in its process. These intermediates were phthalimide **27**, ester **28**, formamide **29**, formamide **30** and isonitrile **31**.

First and second step of reactions (amine protection using phthalic anhydride and alcohol protection using acetic anhydride) gave first intermediate of phthalimide **27** in 64% yield. Then glycosylation reaction has been conducted as third step of reaction using isopropyl alcohol to provide ester **28** in 30% yield. Formamide **29** was produced by 2 step of reactions, i.e. deprotection of phthaloyl and acetyl groups using ethylene diamine then formylation reaction using methyl formate and methanol. Acylation reaction using acyl chloride as sixth step produced two acylated products. The first acylated product (formamide **30**) was produced by reacting formamide **29** and benzoyl chloride at temperature of 60°C in 46% yield. Then second acylated product (formamide **32**) was produced by reacting formamide **29** and octanoyl chloride at room temperature in 24% yield. Final products were achieved via isonitration reaction (seventh step) in 35% yield of isonitrile **31** and 60% yield of isonitrile **32**. Absolute configurations of the product were established through total synthesis. Antifouling activity (EC₅₀) results of isonitrile **31** and **33** against cypris larvae of *Amphibalanus amphitrite* were 0.81 and 0.79 µg/mL respectively without significant toxicity (LC₅₀ >10 µg/mL).

Keywords : Antifouling agents, D-glucosamine, Isonitrile **31** and **33**.

ABSTRAK

SINTESIS SENYAWA ISONITRIL (GLU-OiPR-OBZ₃ DAN GLU-OiPR-OCT₃) SEBAGAI AGEN ANTIFOULING BARU DARI D-GLUKOSAMIN

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Dua agen *antifouling* yaitu Glu-OiPr-Obz₃ (isonitril **31**) dan Glu-OiPr-Oct₃ (isonitril **33**) telah disintesis dari D-glukosamin dan diuji aktivitas *antifouling*-nya. Senyawa isonitril **31** dan **33** dicapai melalui jalur sintesis sederhana (7 tahapan reaksi) yang menghasilkan 5 senyawa intermediet utama dalam prosesnya. Senyawa intermediet tersebut adalah ftalimida **27**, ester **28**, formamida **29**, formamida **30** dan isonitril **31**.

Reaksi tahap pertama dan kedua (proteksi amin menggunakan ftalil anhidrida dan proteksi alkohol menggunakan asetat anhidrida) menghasilkan intermediet pertama yaitu phthalimide **27** dengan *yield* sebesar 64%. Kemudian reaksi glikosilasi dilakukan sebagai tahap ketiga menggunakan isopropil alkohol menghasilkan ester **28** dengan *yield* sebesar 30%. Formamida **29** dihasilkan melalui 2 tahapan reaksi, yaitu deproteksi gugus ftaloil dan gugus asetil menggunakan etilendiamina kemudian reaksi formilasi menggunakan metil format dan metanol. Reaksi asiliasi menggunakan asil klorida menghasilkan dua produk asilasi. Produk asilasi pertama (formamida **30**) dihasilkan dengan mereaksikan formamida **29** dan benzoil klorida pada suhu 60°C dengan *yield* sebesar 46%. Kemudian produk asilasi kedua (formamida **32**) dihasilkan dengan mereaksikan formamida **29** dan oktanoil klorida pada suhu kamar dengan *yield* sebesar 24%. Produk akhir didapatkan melalui reaksi isonitrilasi (tahap ketujuh) dengan *yield* sebesar 35% untuk isonitril **31** dan *yield* sebesar 60% untuk isonitril **32**. Nilai konfigurasi absolut dari setiap senyawa sudah ditentukan pada setiap langkah sintesis. Hasil uji aktivitas *antifouling* (EC₅₀) senyawa isonitril **31** dan **33** terhadap larva cypris *Amphibalanus amphitrite* didapatkan sebesar 0.81 dan 0.79 µg/mL secara berurutan dengan nilai toksisitas yang rendah (LC₅₀ >10 µg/mL).

Katakunci : Agen *antifouling*, D-glukosamin, isonitril **31** dan **33**