

**SINTESIS MALEATED CASTOR OIL (MACO) SEBAGAI BIO-BASED
PLASTICIZER BERDASARKAN VARIASI MASSA MALEAT
ANHIDRIDA (MAH) DAN PENGARUHNYA TERHADAP SIFAT
MEKANIK KARET NITRIL BUTADIENA (NBR)**

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INTISARI

Penelitian ini bertujuan untuk melakukan sintesis *maleated castor oil* (MACO) melalui esterifikasi *castor oil* dan maleat anhidrida (MAH) dengan xilena sebagai *water entrainer* berdasarkan variasi massa MAH, mempelajari pengaruh variasi massa MAH terhadap angka asam dan viskositas MACO hasil sintesis dan pengaruh penambahan MACO terhadap sifat kuat tarik, perpanjangan putus, kekerasan, *swelling*, dan eksudasi. Sintesis MACO dilakukan melalui reaksi esterifikasi antara *castor oil* dan MAH dengan xilena sebagai *water entrainer* selama 5 jam berdasarkan variasi massa MAH (rasio mol CO : MAH 4:4, 4:3, 4:2, dan 4:1) dilanjutkan destilasi 1 jam dan evaporasi. Produk MACO diuji angka asam dan viskositas, dianalisis struktural dengan spektroskopi FTIR dan ¹H-NMR, dan diaplikasikan sebagai *plasticizer* pada NBR. Kompon karet dikarakterisasi menggunakan *rheometer* dengan suhu 170 °C lalu divulkanisasi. Vulkanisat dikarakterisasi kuat tarik, perpanjangan putus, kekerasan, *swelling*, dan eksudasi.

MACO berwujud larutan kental berwarna kuning tua. Angka asam dan viskositas MACO hasil sintesis meningkat seiring penambahan massa MAH. Viskositas MACO1, MACO2, MACO3, dan MACO4 berturut-turut yaitu 1010; 819,8; 709,8; dan 499,9 cP. MACO berpotensi digunakan sebagai *bio-based plasticizer* alternatif pengganti DOP karena memiliki kinerja yang baik, yaitu dapat menambah *cross-linking*, menurunkan waktu *scorch*, meningkatkan waktu optimum *curing*, serta tidak memberikan efek negatif terhadap sifat kuat tarik, perpanjangan saat putus, kekerasan, *swelling*, dan eksudasi.

Kata kunci: *bio-based plasticizer*, *castor oil*, esterifikasi, karet nitril butadiena, dan *maleated castor oil*.

SYNTHESIS OF MALEATED CASTOR OIL (MACO) AS A BIO-BASED PLASTICIZER BASED ON MALEIC ANHYDRIDE (MAH) MASS VARIATION AND ITS EFFECT ON THE MECHANICAL PROPERTIES OF NITRILE BUTADIENE RUBBER (NBR)

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ABSTRACT

This research aims to synthesize maleated castor oil (MACO) through the esterification of castor oil and maleic anhydride (MAH) with xylene as a water entrainer based on MAH mass variations, studied the effect of MAH mass variation on the acid value and viscosity of synthesized MACO and the effect of MACO addition on the properties of tensile strength, elongation at break, hardness, swelling, and exudation. Synthesis of MACO was carried out through esterification reaction between castor oil and MAH with xylene as a water entrainer for 5 hours based on the mass variation of MAH (4:4, 4:3, 4:2, and 4:1 mole ratio of CO : MAH) followed by distillation for 1 hour and evaporation. MACO products were tested for acid value and viscosity, structurally analyzed by FTIR and ¹H-NMR spectroscopy, and applied as a plasticizer to NBR. The rubber compound was characterized using a rheometer with 170 °C temperature and then vulcanized. Vulcanisates are characterized by tensile strength, elongation at break, hardness, swelling, and exudation.

MACO is a dark yellow viscous liquid. The acid value and viscosity of the synthesized MACO increased along with the addition of the mass of MAH. The viscosities of MACO1, MACO2, MACO3, and MACO4 were 1010; 819.8; 709.8; and 499.9 cP respectively. MACO has the potential to be used as an alternative bio-based plasticizer to substitute DOP because it has good performance, which can increase cross-linking, decrease scorch time, increase optimum curing time, and does not have a negative effect on tensile strength, elongation at break, hardness, swelling and exudation.

Keywords: bio-based plasticizer, castor oil, esterification, maleated castor oil, and nitrile butadiene rubber.