

**Title** Correlation of speed of sound in Biodiesels to its Thermodynamic Parameters

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### Abstract

Speed of sound is great importance for fuel injection timing and combustion timing in the diesel engines. In this study correlation of speed of sound in fatty acid methyl ester (FAME), fatty acid ethyl esters (FAEE) methyl-biodiesels and ethyl-biodiesels are correlated to the Martin's rule of free energy additivity for predicting speed of sound from their own equations. The speed of sound in FAME, FAEE, methyl-biodiesels and ethyl-biodiesel can be easily predicted from its carbon number ( $z$ ), number of double bonds ( $n_d$ ) at different temperatures ( $T$ ). The average absolute deviation (AAD) in predicting of FAME, FAEE, methyl-biodiesels and ethyl-biodiesels are 0.35, 0.56, 0.36 and 0.31%, respectively. In addition, speed of sound in methyl-biodiesels and ethyl-biodiesels can be predicted from average carbon number of atoms ( $z_{(ave)}$ ) and number of double bonds average ( $n_{d(ave)}$ ) of fatty acids. The speed of sound outside temperature between 278.15 and 353.15 K may be possibly predicted by this model but accuracy may be lower.

**Keywords:** Law of Free Energy Additivity, Estimating, Speed of Sound, Biodiesel