Kajian Eksperimental Pengaruh Etanol Pada Premium Terhadap Karakteristik Pembakaran Kondisi Atmosferik Dan Bertekanan Di Motor Otto Silinder Tunggal Sistem Injeksi = Experimental Study of The Influence of Ethanol-Premium Blends on Combustion Characteristics at Atmospheric Condition And Pressurized in a Single Cylinder Spark Ignition Engine.

Atok Setiyawan, author

Abstrak

Penggunaan etanol sebagai bahan bakar pada motor Otto baik dedicated maupun sebagai campuran pada gasoline, masih banyak dijadikan sebagi obyek penelitian. Hal ini sejalan dan harus disesuaikan dengan perkembangan teknologi dan kinerja motor Otto, reformulasi bahan bakar gasoline maupun pengurangan emisi gas buang. Penambahan etanol pada premium akan merubah sifat-sifat utama bahan bakar yang terkait dengan karakteristik pembakaran. Penelitian difokuskan pada karakterisasi pembakaran premium, etanol dan campurannya dengan kondisi atmosferik pada Kalorimeter Api dan bertekanan pada motor Otto. Karakterisasi pembakaran kodisi atmosferik dipengaruhi oleh konsentrasi etanol dalam premium sedangkan untuk bertekanan di motor Otto dengan beberapa paramater bervariasi yang meliputi: konsentrasi etanol dan λ pada kondisi operasional motor secara umum/pemakaian harian yang meliputi: MBT, beban 3 kW (Widely Open Throttle-WOT), putaran 4000 rpm. Sifat-sifat penting yang berubah dengan penambahan etanol pada premium adalah: penambahan 5% (v/v) etanol memberikan efek azeotropika tertinggi dengan nilai RVP sebesar 71,4 kPa, RON dan kalor penguapan meningkat masing-masing sebesar 1,9 point dan 10% tetapi nilai kalor menurun sebesar 1,4% dibandingkan premium. Karakteristik pembakaran kondisi atmosferik: setiap penambahan etanol 10% (v/v) akan menurunkan laju pelepasan massa dan kalor masing-masing sebesar 5,8% dan 8,4% untuk massa bahan bakar yang sama. Sedangkan karakteristik pembakaran betekanan di motor Otto: ignition delay tidak berubah secara signifikan, durasi pembakaran meningkat dari 41°CA menjadi 45°CA, setiap penambahan 10% (v/v) etanol berpengaruh pada: konsumsi bahan bakar dan laju pelepasan massa masing-masing meningkat rata-rata sebesar 12,8% dan 11,3%, tetapi laju pelepasan kalor menurun sebesar 2,1%. Efek positif dari penambahan etanol pada premium adalah penurunan emisi gas buang berupa CO2, CO dan HC masing-masing maksimum sebesar 4,4%, 14,5% dan 17,4%. Karakteristik pembakaran kondisi atmosferik dan bertekanan di motor Otto yang berupa laju pelepasan massa menunjukkan sifat yang antagonis, tidak demikian halnya dengan laju pelepasan kalor. Penambahan etanol pada premium untuk aplikasi motor Otto menunjukkan efek negatif berupa meningkatnya konsumsi bahan bakar dan efisiensi termal tetapi berdampak positif terhadap penurunan emisi gas buang.

<i>The use of ethanol as a motor fuel in both dedicated and as blends in gasoline is still interesting as objects of research. This is in line and should be adjusted with several issues i.e.: the development of technology and performance of Spark Ignition Engine (SIE), fuel reformulation of gasoline and the reduction of exhaust emissions. The addition of ethanol on premium will change the predominant properties associated with combustion characteristics. Research was focus on the characterization of the combustion of premium, ethanol and the blends in two methods, i.e.: atmospheric condition in a Cone Calorimeter and

pressurized in a SIE. The parameter of test for atmosphric combustion characterics was concentration of ethanol in premium only. While for pressurized condition in the SIE, many parameters were varied includes: ethanol concentration and λ based on daily motor operation i.e.: at MBT, load was 3 kW (Widely Open Throttle-WOT), speed was 4000 rpm. The important properties were changed by the addition of ethanol on premium i.e.: addition of a 5% (v/v) delivered the highest value of the azeotrope effect with RPV of 71,4 kPa, Ron and heat of vaporization increased by 1.9 point and about 10% respectively if compared to premium. For the atmospheric combustion characteristics, the addition of a 10% (v/v) ethanol decreased mass and heat release rate as much as 5.8% and 8.4% respectively for the same quantitative of fuel. Meanwhile the pressurized combustion characteristics in SIE showed that ignition delay was not changed significantly, the duration of combustion increased from 41 to 45°CA, the addition of 10% (v/v) ethanol increased fuel consumption and the mass release rate on average by 12.8% and 11.3% respectively, but the rate of heat release decreased by 2.1% compared to premium. The positive effects of the addition of ethanol on premium were a decreased in exhaust emission of CO2, CO and HC at a maximum value of 4.4%, 14.5% and 17.4% respectively compared to premium. Athomspheric and pressurized combustion characteristics in term of mass release rate showed the nature of the antagonist behaviour, is not the case with the rate of heat release. The addition of ethanol on premium for SIE application demonstrated the negative effects, mainly an increasing fuel consumption and thermal efficiency but positively impact on a decreasing exhaust gas emission.</i>