Using Preheated Crude Sunflower Oil as a Fuel in a Diesel Engine

A. N. OZSEZEN

Department of Automotive Engineering Technology, Kocaeli University, Izmit, Turkey

Abstract In this study, preheated crude sunflower oil at 75°C was used in a four-cylinder, naturally aspirated, indirect injection diesel engine. The experiments were conducted at the constant engine speeds under the full load condition of the engine to determine the performance, combustion, and injection characteristics of test fuels. The engine test results have been compared with the reference values that were determined by using petroleum-based diesel fuel. The results indicated that when the test engine was fueled with preheated crude sunflower oil, the brake thermal efficiency and brake specific fuel consumption increased by 1 and 5%, respectively, while brake power decreased by 1%. The cylinder gas pressure and the heat release curves of preheated crude sunflower oil appeared similar to those of petroleum-based diesel fuel. However, in detailed combustion analyses, it was found that the start of injection timing of preheated crude sunflower oil is earlier, its ignition delay is longer, and also its combustion duration is shorter than those of petroleum-based diesel fuel for all test conditions. The results of the emission test showed that when using the preheated crude sunflower oil, on average, unburned HC, CO, CO₂ emissions, and smoke opacity decreased by 39, 6, 9, and 5%, respectively. Consequently, it was observed that, for a short term usage, the preheated crude sunflower oil presents satisfactory results in terms of engine performance and combustion characteristics.

Keywords combustion, diesel engine, emissions, performance, preheated crude sunflower oil

1. Introduction

The increase in the alternative diesel fuel diversity has become progressively more important for diesel engines, which have a vital role particularly for transportation systems. Besides, increasing global concern due to environmental pollution from internal combustion engines has generated to focus on the oxygenated alternative diesel fuels. These topics have triggered various research studies to replace petroleum-based diesel fuel with the vegetable oils or their derivations (Canakci et al., 2009). Actually, the use of vegetable oils as fuel for internal combustion engines is not new. Rudolf Diesel, the inventor of the diesel engine, developed the first engine to run on peanut oil. Despite its success, when diesel engines were operated with vegetable oils for short-term usage, the high viscosity and density of vegetable oils led to problems in the injection system and combustion chamber of the diesel engines for long-term usage (Demirbas, 2008).

Address correspondence to Dr. Ahmet Necati Ozsezen, Department of Automotive Engineering Technology, Kocaeli University, Izmit 41380, Turkey. E-mail: nozsezen@hotmail.com