

Dedication

I dedicate this work

To

my father, my mother

And

To

my

family

Maria

Acknowledgment

I have the pleasure to acknowledge the contribution of many people in this work, the support and guidance of my supervisor prof Nafie Abdellateef.

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Abstract

In this study a portable laser absorption system was designed and operated to detect nitrogen dioxide gas (NO_2) concentration which is a common air pollutant, by means of measurements of laser beam intensity transmitted through this gas inside a glass tube using laser absorption spectroscopy.

Diode laser of 650 nm wavelength and power of 10 mW with photodiode detector, was used to calculate the concentration of NO_2 in samples collected from cars exhaust using petroleum products (benzene, gasoline, gas, and mixture of benzene and oil) as fuel, and from petroleum refinery station out of Khartoum at distances of 300m and 2000m apart.

The study was illustrated that, the attenuation of laser intensity by NO_2 and the concentration of it in the collected samples depends on the

sort of the fuel, the age of the engine, while for it depends on the distance between the sample collection area and the refinery.

The system succeeded to detect the existence of NO₂ in the collected samples. The system was able to determine the NO₂ concentration in all the samples with high efficiency in a simple way to get real and accurate results. The system was so cheap, fast and simple to be used as a portable device in different areas of fuel combustion without need of fixed lab.

المستخلص

في هذه الدراسة تم تصميم وتشغيل منظومة كشف متنقلة تعتمد على مطيافية امتصاص الليزر لتحديد تركيز غاز ثاني أكسيد النيتروجين (NO₂) الذي يعتبر من ملوثات الهواء الشائعة وذلك من خلال قياس الشدة الممتصة لشعاع الليزر بواسطة هذا النوع من الغازات في داخل أنبوب زجاجي يتم التحكم في مرور الليزر بداخله بطريقة خاصة.

استخدم في هذه المنظومة ليزر الثنائي ذي الطول الموجي 650 نانوميتر بقدرة 10 ملي واط وكاشف ضوئي من نوع الثنائي الضوئي لقياس نسبة تركيز غاز ثاني أكسيد النيتروجين (NO₂) في عينات تم جمعها من عوادم أنواع مختلفة من السيارات ومن أحد المصافي النفطية خارج الخرطوم.

أجريت هذه الدراسة على عينات من مركبات نواتج احتراق الوقود في مجموعة من محركات السيارات التي تستخدم منتجات البترول (البنزين، الجازولين، الغاز، وخليط من البنزين والزيوت) كوقود حيث تم جمع العينات من عوادم هذه السيارات بالإضافة إلى عينات من مناطق تبعد 300 و 2000 متر عن مخلفات الاحتراق في أحد مصافي البترول.

أظهرت الدراسة أن معامل التوهين وتركيز غاز ثاني أكسيد النيتروجين (NO₂) في العينات المجمعة من عوادم المحركات يختلف باختلاف نوع الوقود المستخدم وعمر محرك السيارة. أما بالنسبة للمصفاة

فقد كان تركيز الغاز يختلف باختلاف المسافة عن المصفاة. أثبتت الدراسة نجاح المنظومة في كشف وجود غاز (NO_2) ونسب مختلفة في العينات المجمعة وأن المنظومة استطاعت تحديد هذه التراكيز بشكل كفؤ وفي ضغوط مختلفة مما يثبت إن هذه المنظومة الرخيصة والبسيطة يمكن استخدامها كمنظومة محمولة للعمل في الميادين المختلفة دون الحاجة إلى جلب العينات إلى المعمل لتعطي قياسات حقيقية لتراكيز غاز (NO_2) وبزمن وجيز جداً وبصورة كفؤة في أي ميدان يستخدم احتراق الوقود في عمله.

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