

INTI SARI

APLIKASI SPEKTROMETER FOTOAKUSTIK LASER CO₂ DALAM PENGUKURAN KONSENTRASI GAS ASETON PADA GAS HEMBUS NAFAS PASIEN KANKER PARU

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Penelitian mengenai konsentrasi gas aseton pada relawan kanker paru dan relawan kontrol (relawan penyakit paru selain kanker dan relawan sehat) telah dilakukan. Sebelum dilakukan pengukuran konsentrasi pada relawan, daya laser CO₂ terlebih dahulu dioptimasi sehingga didapatkan daya tertinggi sebesar 41,23 W. Karakterisasi spektrometer fotoakustik yang dilakukan meliputi pemayaran garis laser CO₂, garis serapan gas etilen, aseton dan amonia, penentuan kurva resonansi dan faktor kualitas serta pengukuran derau. Hasil karakterisasi didapatkan faktor kualitas pada garis 10P14, 10P20 dan 10R14 masing-masing sebesar (31 ± 6) , (27 ± 4) dan (45 ± 12) . Sedangkan batas deteksi terendah pengukuran gas etilen, aseton dan amonia yaitu (22 ± 2) ppb, (30 ± 4) ppb dan (12 ± 1) ppb.

Metode pengambilan sampel gas hembus nafas relawan dilakukan secara *off-line* dan noninvasif dengan menyimpan sampel menggunakan *sample bag* untuk kemudian diukur menggunakan spektrometer fotoakustik laser CO₂. Hasil pengukuran diolah menggunakan metode multikomponen dan diperoleh konsentrasi rata-rata gas aseton pada relawan sehat, penyakit paru selain kanker paru dan relawan kanker paru berturut-turut adalah sebesar $(0,57 \pm 0,12)$ ppm, $(0,63 \pm 0,09)$ ppm dan $(1,07 \pm 0,18)$ ppm.

Kata kunci: Spektrometer Fotoakustik Laser CO₂, Gas Hembus Nafas, Kanker Paru, Aseton

ABSTRACT

APPLICATION OF CO₂ LASER PHOTOACOUSTIC SPECTROMETER IN MEASURING ACETONE GAS CONCENTRATION OF LUNG CANCERS PATIENT'S EXHALED BREATH

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The research examined acetone gas concentrations in the exhaled breath of lung cancer subjects and in the control subjects (i.e. those with lung diseases other than lung cancer, and those who are considered healthy). Prior to the measurement of the concentration to the subjects, the CO₂ laser power was first optimized to the highest point of 41.23 W, which was followed by photoacoustic spectrometer characterization, that included CO₂ laser line scanning; ethylene, acetone and ammonia gas absorption line scanning; determination of resonance curve and quality factors; and noise measurement. Characterization produced the quality factors on 10P14, 10P20 and 10R14 lines of (31 ± 6) , (27 ± 4) and (45 ± 12) respectively, while the lowest detection limits on the measurements of ethylene, acetone and ammonia gases were (22 ± 2) ppb, (30 ± 4) ppb and (12 ± 1) ppb.

The sampling of exhaled breath was conducted offline and non-invasively by storing the samples in sample bags for later measurements using a CO₂ laser photoacoustic spectrometer. The results of the measurements were subsequently processed using multicomponent method. It was revealed that the average concentrations of acetone gas in the exhaled breath of healthy, lung diseases other than lung cancer and lung cancer subjects were (0.57 ± 0.12) ppm, (0.63 ± 0.09) ppm and (1.07 ± 0.18) ppm, respectively.

Keyword: CO₂ Laser Photoacoustic Spectrometer, Exhaled Breath, Lung Cancer, Acetone