

Optimasi produksi gas hidrogen dan oksigen melalui reaksi elektrolisis larutan KOH dengan metode elektroda unggun tetap stainless steel ball = Optimization of hydrogen and oxygen gas production through electrolysis reaction of KOH solution using the fixed bed electrode method of stainless steel ball

Nanda Septian Hogantara, author

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Abstrak

Gas hidrogen merupakan bahan bakar hijau yang ramah lingkungan karena proses pembakarannya yang tidak menghasilkan gas karbon dioksida (CO₂). Di sisi lain, kebutuhan oksigen untuk menangani pasien khusus harus tersedia secara instan. Ketersediaan gas hidrogen harus diproduksi dengan teknologi yang cukup rumit seperti steam reforming, sedangkan produksi oksigen harus menggunakan teknologi yang sangat kompleks yakni teknologi kriogenik. Penelitian ini berupaya memberikan solusi yang sederhana dan mudah dioperasikan untuk memproduksi gas H₂ maupun O₂ melalui reaksi elektrolisis larutan KOH menggunakan metode elektroda unggun tetap yang tersusun atas stainless steel ball. Rancangan unggun tetap dengan berat unggun 300 gram didapatkan luas permukaan sebesar 362 cm², tinggi unggun 3,05 cm, yang tersusun atas 286 stainless steel ball ukuran diameter 0,635 cm/ball. Terdapat tiga buah variasi yang dilakukan pada penelitian ini yaitu tegangan listrik (3, 3,5, 4, 4,5, dan 5 V), laju alir sirkulasi elektrolit (100, 200, 300, 400, 500 mL/menit), dan kadar KOH (1%, 2%, 3%, 4%, dan 5% W/W). Hasil percobaan menunjukkan kondisi optimum diperoleh pada tegangan 3 V, laju alir sirkulasi elektrolit 500 mL/menit, dan kadar KOH 3% didapatkan produktivitas gas hidrogen sebesar 0,813 mL/s dan oksigen sebesar 0,409 mL/s serta efisiensi energi sebesar 49,75%..... Hydrogen gas is a green fuel that is environmentally friendly because the combustion process does not produce carbon dioxide (CO₂) gas. On the other hand, oxygen requirements for treating special patients must be available instantly. The availability of hydrogen gas must be produced with a complicated technology such as steam reforming, while the production of oxygen must use a very complex technology, namely cryogenic technology. This study seeks to provide a simple and easy-to-operate solution to produce H₂ and O₂ gas through the electrolysis reaction of KOH solution using a fixed bed electrode method composed of stainless steel ball. The fixed bed design with a bed weight of 300 grams obtained a surface area of 362 cm², a bed height of 3,05 cm, which was composed of 286 stainless steel balls with a diameter of 0,635 cm/ball. There are three variations carried out in this study, namely the electric voltage (3, 3,5, 4, 4,5, and 5 V), the circulation rate of the electrolyte solution (100, 200, 300, 400, 500 mL/minute), and KOH content (1%, 2%, 3%, 4%, and 5% W/W). The experimental results showed that the optimum conditions were obtained at a voltage of 3 V, a circulation rate of 500 mL/minute of electrolyte solution, and a 3% KOH level. The productivity of hydrogen gas was 0,813 mL/s and oxygen was 0,409 mL/s and energy efficiency was 49,75%.