INTISARI

Pengembangan hidrogen melalui *hydrogen fuel cell vehicles* disinyalir mampu meminimalisir emisi yang lebih baik dalam upaya mendukung *net zero emission*. Inovasi dari *hydrogen fuel cell vehicles* diikuti dengan perhatian terhadap tingkat keselamatan dan kekuatan pada setiap komponen penyokong *hydrogen fuell cell vehicles,* salah satunya adalah *high pressure hydrogen tank* sebagai metode penyimpanan hidrogen. Beberapa studi telah melakukan penelitian terhadap faktor yang dapat mempengaruhi efisiensi dari tanki melalui prosedur eksperimental dan numerikal. Pada penelitian ini, digunakan studi numerikal berupa simulasi *computational fluid dynamics* (CFD) dalam meninjau faktor yang mempengaruhi tidak hanya keselamatan, tetapi juga efektivitas proses pengisian pada *high pressure hydrogen tank*, khususnya tipe IV yang meliputi distribusi temperatur, kenaikan temperatur, perubahan tekanan, dan nilai *state of charge* (SOC). Proses penelitian melibatkan total sembilan variasi yang diberikan konfigurasi pada arah dan derajat *inlet* dengan sembilan variasi diaplikasikan nilai *length ratio* 40%. Melalui proses simulasi, diperoleh bahwa dengan perbedaan pada konfigurasi *inlet*, tidak ada perbedaan signifikan pada kenaikan temperatur dan lama pengisian antar variasi dan dengan merubah arah dan derajat *inlet* mampu menghadirkan proses pengisian yang lebih cepat 0,5 detik dibandingkan konfigurasi *inlet axial*. Kemiringan derajat *inlet* juga menghadirkan distribusi temperatur yang lebih homogen dan merata, dengan variasi kelima menghadirkan distribusi temperatur yang merata dengan selisih antara pembacaan suhu pada tanki secara langsung dan melalui termokopel dibandingkan variasi lainnya. Perubahan tekanan antar setiap variasi tidak menunjukkan perbedaan yang signifikan. Nilai SOC antar variasi juga tidak memiliki selisih yang banyak dengan variasi kedua menghadirkan nilai SOC yang baik, tetapi belum memenuhi angka yang dibutuhkan.

Kata kunci : *high pressure hydrogen tank*, distribusi temperatur, kenaikan temperatur, lama pengisian, *nominal working pressure, state of charge*

ABSTRACT

The development of hydrogen through hydrogen fuel cell vehicles is alleged to be able to minimize emissions better in an effort to support net zero emissions. The innovation of hydrogen fuel cell vehicles is followed by attention to the level of safety and strength of each component supporting hydrogen fuel cell vehicles, one of which is the high pressure hydrogen tank as a hydrogen storage method. Several studies have conducted research on factors that can influence tank efficiency through experimental and numerical procedures. In this research, a numerical study in the form of computational fluid dynamics (CFD) simulation was used to review the factors that influence not only safety, but also the effectiveness of the filling process in high pressure hydrogen tanks, especially type IV, which includes temperature distribution, temperature rise, pressure changes, and state of charge (SOC) value. The research process involved a total of nine variations given the configuration in the direction and degree of the inlet with nine variations applying a length ratio value of 40%. Through the simulation process, it was found that with differences in inlet configuration, there was no significant difference in temperature increase and filling time between variations and by changing the direction and degree of the inlet it was able to provide a filling process that was 0.5 seconds faster than the axial inlet configuration. The degree slope of the inlet also provides a more homogeneous and even temperature distribution, with the fifth variation presenting an even temperature distribution with the difference between temperature readings on the tank directly and via the thermocouple compared to the other variations. The pressure changes between each variation did not show a significant difference. The SOC value between variations also does not have much difference with the second variation presenting a good SOC value, but not yet meeting the required number.

Keywords: high pressure hydrogen tank, temperature distribution, temperature rise, charging time, nominal working pressure, state of charge