On-site hydrogen production to refuel cell cars

EU researchers have developed new methods for efficiently converting liquid fuels such as diesel or biodiesel into hydrogen. Refinements promise cost-effective, decentralised hydrogen production with the potential to transform fuel production and distribution across the EU.

Fuel cell and hydrogen technologies are expected to play a vital role in helping the EU achieve its 2020 vision of reducing greenhouse gas emissions. Yet, despite technical improvements, there are still numerous hurdles facing large-scale adoption of these technologies in the market, such as lack of infrastructure and reduction in production costs. Hydrogen production directly on site would make it much more convenient for fuel cell cars to be filled up.

Technology developed within the NEMESIS2+ (New method for superior integrated hydrogen generation system 2+) project could act as a bridge for creating the necessary hydrogen infrastructure, while also overcoming key issues related to hydrogen production.

Researchers successfully developed a small-scale prototype system that can easily be integrated into existing refuelling stations. This pre-commercial hydrogen generator running on biodiesel produces 50 Nm3 hydrogen per hour.

What increases compactness of the new reactor and reduces investment costs is the one-reformer concept, which removes the pre-former stage found in the original NEMESIS project. The new design includes a dual-fuel burner, allowing it to process both gas from the hydrogen-conditioning module as well as liquid fuels. Using liquid fuels in steam reforming technology enabled the new system to operate at higher pressures (12 bars), scale up capacity through the use of a modified tubular reforming technology and reduce production costs.

Until now, hydrogen production methods have been costly and unsustainable, using either fossil fuel sources such as natural gas or water electrolysis, which is currently less efficient. Hydrogen production from biodiesel may be a clean alternative for now, however, it is a challenging process. Deactivation of the catalysts used by sulphur impurities on their surface causes a reduction in the amount of hydrogen produced.

To reduce the sulphur content, project members successfully built a desulphurisation module that works on the principle of liquid phase adsorption. They conducted numerous experiments to identify the optimal operating conditions. This enabled the team to produce high-quality hydrogen with a purity of almost 100 %, with a system conversion efficiency amounting to 70 %.

The NEMESIS2+ prototype system can be integrated into existing infrastructure, making possible hydrogen production from biodiesel directly on site at conventional filling stations. In addition, it can find application for processes used within the glass
and steel industries.

**Related information**

**Report Summary**

Final Report Summary - NEMESIS2+ (New Method for Superior Integrated Hydrogen Generation System 2+)

**Keywords**

Hydrogen production, fuel cell cars, biodiesel, NEMESIS2+

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