

ABSTRACT

Considered as the future energy carrier, hydrogen appears to be the miracle solution to overcome the current energy crisis and environmental problems. This can be possible only by solving all the problems associated with its life cycle (production, distribution, storage and final use).

Regarding the multitude of environmental impacts generated during hydrogen production, the complexity of their evaluation and the possible interactions among them the use of environmental assessment methods is necessary. Therefore, the Exergetic Life Cycle Assessment (ELCA) approach was chosen as the most useful tool for hydrogen production scenarios investigation. It compares the hydrogen production systems in order to identify which one is more eco-efficient and recognizes their opportunities for environmental improvement. Thus, eight scenarios for hydrogen production were studied by the ELCA approach. These scenarios are essentially based on reforming techniques of fossil methane, biomethane and bioethanol.

The results show that the hydrogen produced by fossil methane scenarios, the mature and widely used technique, are the biggest consumers of abiotic resources and most emitters of greenhouse gases (GHG). However, the use of biomethane as hydrogen sources presents an interesting solution. Furthermore, the environmental profile of a hydrogen ex-bio-methane can be a very attractive solution by improving anaerobic digestion system with on-site reforming process. The use of bio-ethanol produced from wheat as a hydrogen source has offensive environmental impacts. In fact, these processes are characterized by great eutrophication and acidification potentials in addition to their emissions of large amount of greenhouse gases (GHG). However, bio-ethanol can be a sustainable and renewable source for hydrogen production on condition that it is produced by environmentally friendly manners.

Keywords: Exergetic Life Cycle Assessment, Hydrogen, Reforming, Methane, Biomethane, Bioethanol, Environmental impact.