ATBEST

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Surplus electricity to biogas via hydrogen

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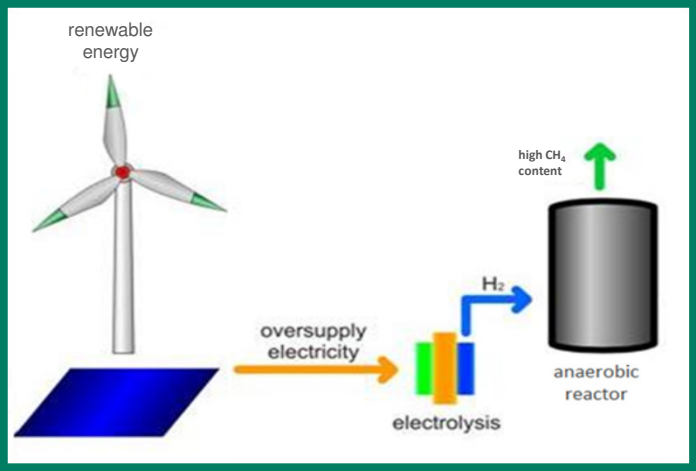
Introduction

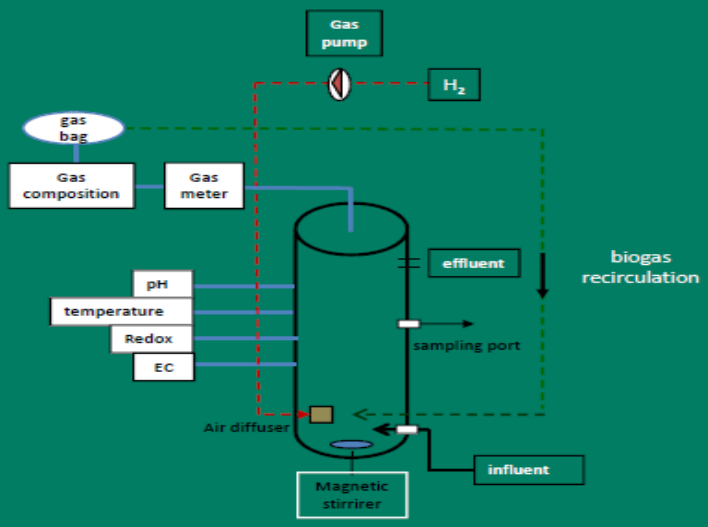
Biogas production is a mature technology. However, possible ways for its efficient utilization and upgrading are yet to be exploited. Biogas can be upgraded to natural gas quality and be used as vehicle fuel, or it can be injected into the existing natural gas grid. By exploiting excess wind mill production through water electrolysis H_2 is produced. Hydrogenotrophic methanogenic archaea can bind H_2 with CO_2:

$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

In times of surplus energy, rich in CH_4 content biogas, upgraded to natural gas quality can be produced.



Experimental configuration



Performance

Operational conditions:

- maintained at 37° C
- sewage sludge as substrate
- trace metal solution
- different loading rates
- biogas recirculation

The system corresponds well. The production rate, biogas and CH_4 yield follow the changes of the operational conditions. It presents:

- stable operation
- increased CH_4 yield
- higher production rate
- slight increase of pH

Future steps

In order to further evaluate Sabatier's reaction potential the following steps will take place:

- Modifications of the existing system
- Identify hydrogenotrophic methanogenic archaea
- Use of H_2 and CO_2 mixture, regardless the availability of biomass
- Implementation of a system with different characteristics

Outcome

The expected outcome of this project is to establish an efficient process which will contribute to the:

- increase of net CH_4 production
- conversion of the excessive renewable energy into a storable gas
- decrease of biogas upgrading costs
- use of the existing infrastructure system for storing electricity