

Quic

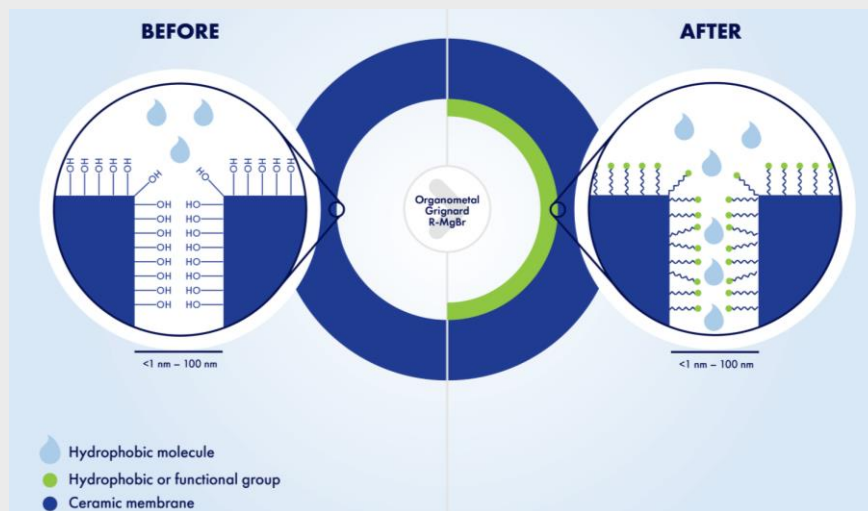
Quality control in Industrial grafting of Ceramic Membranes

Quic aims to benchmark the new production quality and in-line quality control method of the young licensee company A-membranes, to that of the license provider and INNOMEM partner Vito.

THE CONTEXT

A-membranes is a startup company which has acquired the rights to the technology to graft ceramic membranes using organometal (Grignard) chemistry, partially owned by INNOMEM partner Vito. A-membranes is currently investing in the development and implementation of an industrial process for the grafting at high MRL level, and their process differs significantly from the benchmark process used by Vito. Also, Vito's quality control procedure, based on off-line application testing of the grafted membranes, which is a destructive method, is industrially not appealing. Also here, A-membranes has developed entirely new, non-destructive in-line QC- procedures.

With this project, A-membranes seeks to benchmark the production quality of their new and different installation and method to the quality obtained on Vito's pilot equipment. Moreover, they aim to benchmark/correlate the outcome of their new quality control procedures used/developed at A-membranes with/to the Vito off-line test methods.



Effect of Grignard grafting of native ceramic membranes, leading to membranes with increased apolar solvent fluxes, decreased fouling, or tuneable surface chemistry (a-membranes.com).



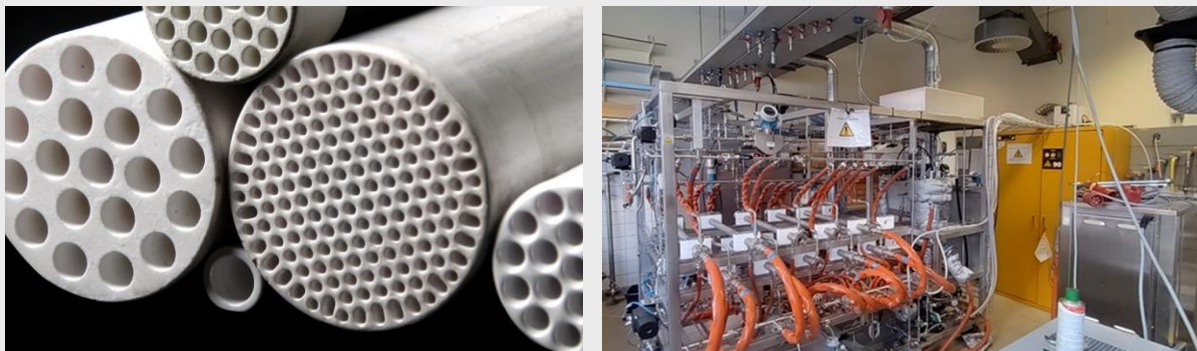
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THE CHALLENGE

While Vito developed a pilot line to graft ceramic membranes, its capacity and approach only suffices to provide a small number of membranes for industrial demonstration cases. Basically, the installation runs max. 10 membranes parallelly - one next to the other - following the single membrane procedures. This remains far below the capacity needs to commercialize the technology on industrial scale, and the approach to copy/paste many times the procedure for a single membrane comes with significant “disadvantages of scale”.

Therefore, A-membranes invested in developing and implementing a new industrial process for grafting, differing significantly from the benchmark at Vito. It uses a completely new reactor approach and design: now batches of membranes are loaded into one single reactor instead of using a single reactor per membrane. This change has got a significant impact on the behaviour of the membranes during 3 out of the 4 production process steps, and on the required process parameters. Careful check of grafting quality in the new process is required.

Vito’s standard QC is based on an off-line, standardized fouling test: the anti-fouling behaviour of the grafted membranes is used as proof of a sufficient degree of surface modification. This is in se a destructive method and not appealing to A-membranes, as each “tested” membrane cannot be sold. Therefore, A-membranes has developed a new, non-destructive in-line QC procedure, that needs benchmarking with the off-line Vito method.

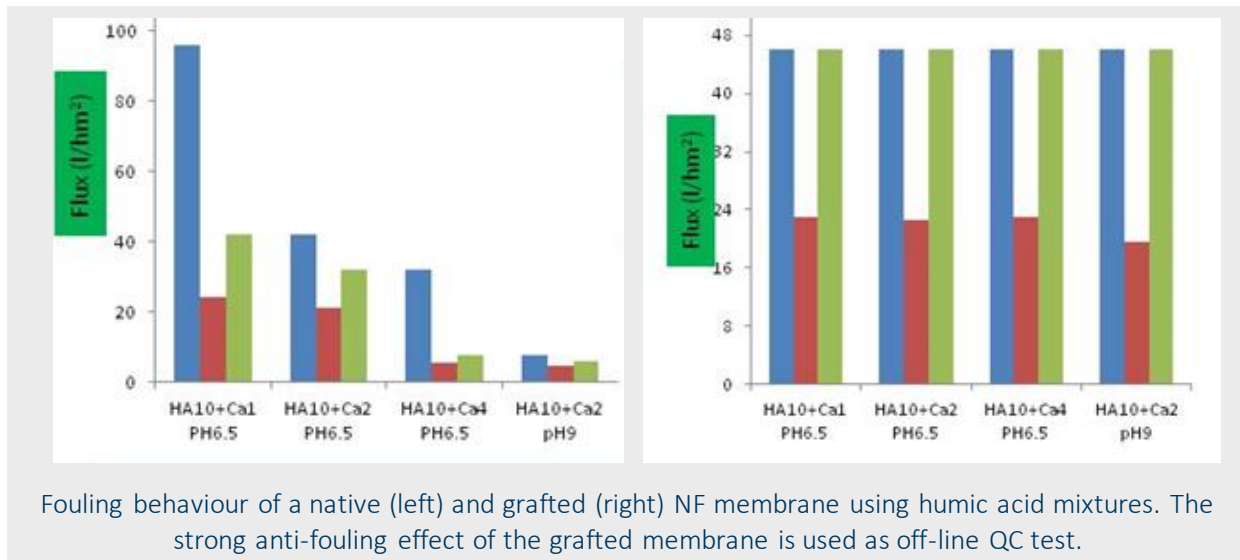


Ceramic membranes (left) and grafting Pilot Line (right) used in the Quic project.

THE RESULTS

Vito grafted 20 commercial-scale (120 cm long), 19-channel membranes using their grafting pilot upgraded and upscaled during the INNOMEM project (see picture above). The native ultrafiltration (UF) membranes and nanofiltration (NF) supports for grafting were delivered by INNOMEM partner Rauschert. In the near future, the produced grafted membranes will be used to benchmark the quality of the first series of large-scale grafted membranes originating from the new production line at A-membranes.

Tests to compare the new in-line quality control method of A-membranes, and the off-line fouling test at Vito are ongoing. First results point to a good correlation of both test results, with a correlation factor > 90% as aimed for. Consequently, A-membranes but also Vito are planning to implement the new QC test in their grafting facilities.



OUTLOOK

The results of the Quic project will allow A-membranes to:

- Launch the industrial production of grafted membranes.
- Offer first volumes of grafted membranes commercially.
- Commission the first industrial production line, increasing the TRL level from 6/7 to 8.
- Apply their technology and modify membranes directly in the production plants of ceramic membrane producers, allowing for larger volumes of identical ceramics / organic group combinations.
- Focus in their production unit on tailoring of membranes for specific smaller volume applications with high added value.

TECHNIQUES USED

In the Quic project the following services and capabilities of the INNOMEM OITB were used:

- Grafting of ceramic NF and UF membranes at INNOMEM partner Vito.
- Testing of grafted ceramic NF and UF membranes produced at A-membranes with model fouling mixtures to determine the grafting quality, performed at INNOMEM partner Vito.
- Analytic tools to evaluate samples taken on-line during grafting at Vito and A-membranes.

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