

# Development of Core Source Technologies for Forward Osmosis/Membrane Distillation Based Advanced Wastewater Treatment

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## 1. Purpose of Research

- The sharp increase of household and industry sewer & waste water in connection with the population increase in the future and industrial advancement incur the enormous water system pollution, requiring diverse environment technology based approach for securing safe water resources as an urgent countermeasure against the mentioned pollution.
- The development of technology accumulated water treatment processes differentiated in terms of application scope, treatment efficiency, and convenience in materializing necessary technologies & process operation in comparison with conventional environmental treatment technologies is required in line with the diverse new water system pollutions and appearance of toxicity manifested substances due to the scientific & industrial technology advancement.

## 2. Major Aspects

- Development of FO, MD, Nano-AD and Photo-AOPs based technologies.
- Application of FO, MD, Nano-AD & Photo-AOPs as key processes based on the relevant source technologies secured. Development of new concept integrated sewer & waste water treatment process through optimum combination of diverse multiple process elements.

## 3. Results

- The integrated sewer & waste water advanced fusion treatment process based on the Forward Osmosis/Distillation Membranes was developed, introducing the core original technologies of re-using the sewer & waste water and making the highly concentrated nitrogen content waste water as resources.

### 1) Development of Fusion Process

- The continuous process for application of MBR-FO & MD on highly concentrated nitrogen content waste water, and the continuous process for organism activation obstructing control operation by concentration of dissolved ions was developed.

### 2) Manufacturing of NT Based FO Membrane

- Supporting membrane capable of reducing CP phenomenon was developed.
- Selection layer holding high water permeation and salt removal functions was developed.
- Optimum performance was realized through optimization of physico-chemical structure of selective layer.

### 3) Nano-AD

- Stable composition technique was selected and optimized.
- Performance of nano organic adsorbents as composed with the optimum condition was evaluated with the influent water quality.
- Nano particle recovery process was introduced considering the front & rear stage linked process.

### 4) MD

- Core element components such as superhydrophobic separation membrane, MD membrane & other core element components were optimized.

## 4. Applications

- FO Technology

- The advanced sewer & waste water integrated treatment technology using the FO developed latest may be applicable to diverse water treatment technologies including the technologies for industrial waste water treatment and recycling technologies.
- The original technologies for FO process used in draw solution and recovery apparatus can be secured through registration of intellectual property, which may be used in worldwide FO process market as a superior technology.

- MD Technology

- As the efficient MD process not only offers effective treatment of industrial waste water but also consumes substantially low energy required for operating the process compared to existing processes, the process can be used a green technology minimizing the generation of carbon.
- The nano-structure oriented superhydrophobic filter as manufactured using the plasma/ion beam surface treatment technology providing superhydrophobic property on the surface of high polymer by coating the hydrophobic nano-film on complex nano-micro structure formed on the surface of high polymer may be applicable to the water purification, gas & ion separation, and oil & water separation areas which required the highly hydrophobic property.

- Nano-AD Technology

- The nano based adsorbent developed can provide the process accomplishing not only the removing of pollutants in sewer & waste water through adsorption but also the controlling of pollutants & reuse of valuable resources simultaneously, which will be able to make the various valuable materials residing in water systems as useful resources through recovery.
- Securing the economy and various compounding technologies for organic core-shell nano particles internationally acknowledged as the environment friendly material with high applicability allows the wide variety of applications of developed materials in non-biodegradable substance removal process, which is regarded to create new water treatment market through such applications.

- Photo-AOPs
  - The optical based advanced oxidation combination process capable of synergic combination oriented from the fundamental mechanism of each advanced oxidation technology can offer the innovative oxidation treatment technology foundation capable of effective control of new harmful substances, toxicity appearing organic pollutants, pathogenic microorganisms & etc. in short period of time, which will allow building of high value added process accordingly.
- Combined Sewer & Waste Water Treatment Process
  - The new combined sewer & waste water treatment process developed through mutually supplementing & synergic combination of various advanced technologies is useful in securing the technical originality and international competitiveness in the aspect that such attempt has been rare in the world, being expected to accordingly create high profit through applications in the variety of environmental companies.
  - The creation of diverse combined sewer & waste water treatment processes through combination of various technologies developed provides the basis for optional selection of specific process suitable for specific singularities of original water characteristics and other major concerned pollutants.

## 5. Source

- Ministry of Environment ([www.me.go.kr](http://www.me.go.kr))