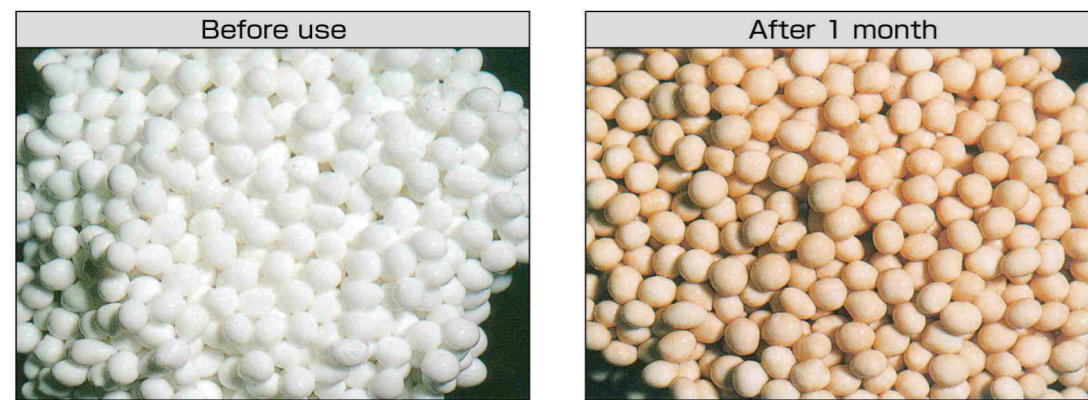
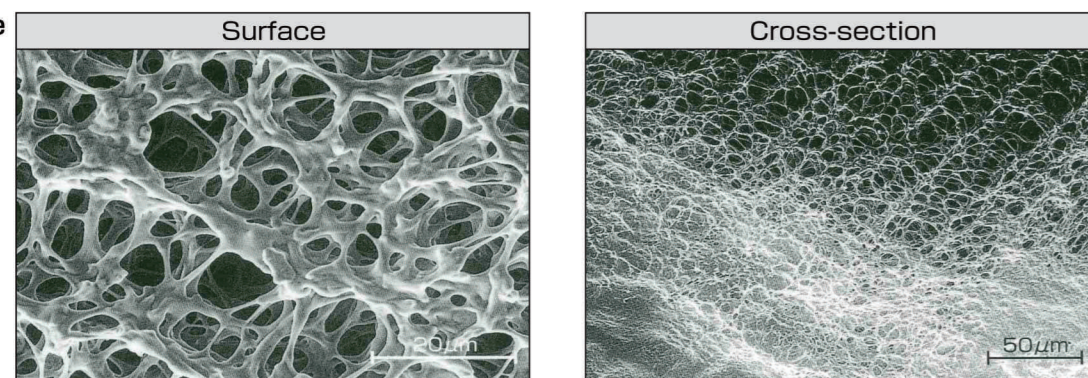


【Appearance of PVA gel】



【Microscopic structure of PVA gel】

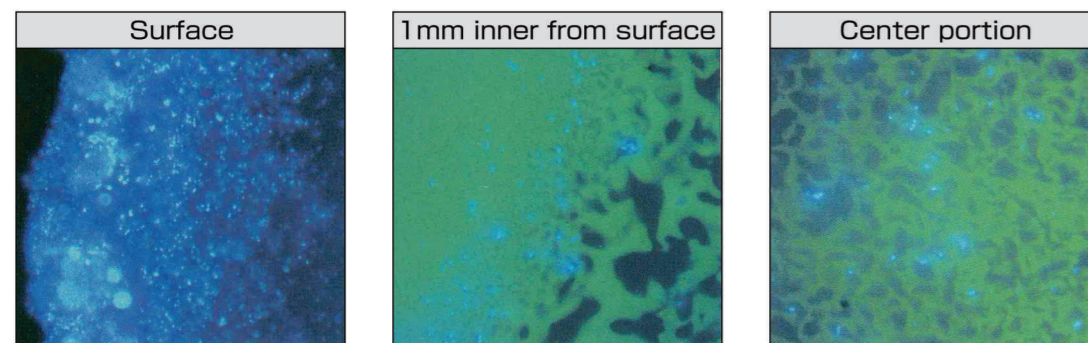
Photograph taken with an Environmental Scanning Electron Microscope (ESEM)



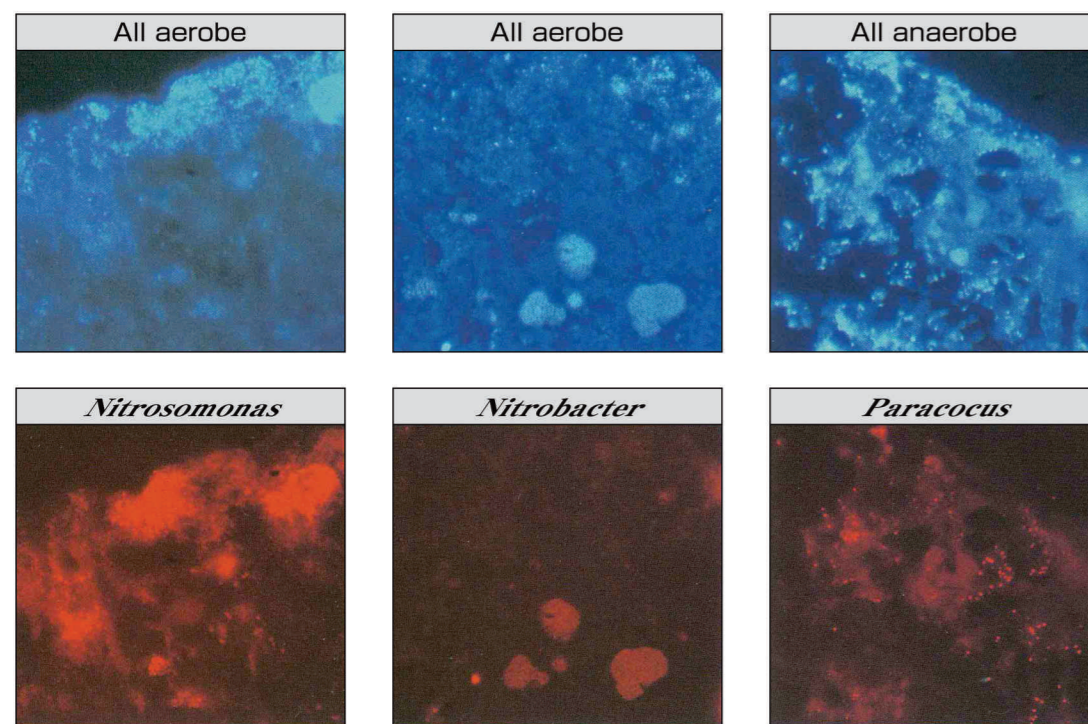
【Distribution of Bacteria】

Fluorescence *in situ* hybridization (FISH) method

■ Bacteria multiply → Toward the center portion of PVA gel.



■ Same field of view.



Example of an autolysis system used for elimination of excess sludge. PVA gel beads are used for biological treatment of industrial wastewater and membranes are used for sludge-water separation.



	Wastewater	Gel tank exit	Autolysis tank	Treated water
s-BOD ₅ (mg/L)	5000	30	—	5
s-COD _{Mn} (mg/L)	4000	500	—	20
MLSS(mg/L)	0	1000	10000	0

GEL tank : BOD volume loading 4kg/m³·d
Autolysis tank : BOD sludge loading 0.05kg/kg-MLSS·d

PVA GEL

Polyvinyl Alcohol Hydrogel
~A carrier for immobilization of microorganisms~

Methods of handling PVA gel beads

- Keep container tightly sealed and out of reach of children when not in use.
- Used PVA gel containing active biomass must be handled with caution (as activated sludge).
- If PVA gel is to be disposed of, it shall be handled as an industrial waste.
- Do not use PVA gel for any other purpose than wastewater treatment.
- Refer to the MSDS prior to handling.

Caution

- PVA gel beads are a slipping hazard when spilled on walking surfaces.
- The water used for packing PVA gel during storage and shipping may be slightly acidic, thus wash thoroughly after contact with skin.
- If the packing water gets in eyes, wash eyes thoroughly with clean water and consult a physician immediately.
- If PVA gel or the packing water is ingested, consult a physician immediately.

DISTRIBUTED BY



12195 Highway 92, Suite 114 PMB #324, Woodstock, GA 30188
Gus Galdo Cell: 678-428-5804 gus@tg-water.com
Tim Acevedo Cell: 404-620-8976 tim@tg-water.com

KURARAY CO., LTD.

Environmental Business Development and Promotion Division
 OTE CENTER BLDG., 1-1-3, Otemachi, Chiyoda-ku, Tokyo 100-8115, Japan
 TEL:+81-3-6701-1550 FAX:+81-3-6701-1654
<http://www.kuraray.co.jp/>

kuraray

PVA GEL

Polyvinyl Alcohol Hydrogel
~A carrier for immobilization of microorganisms~

KURARAY CO., LTD.

PVA gel from Kuraray Company is a biocarrier used to enhance wastewater treatment and thus protect our Earth's environment.

Through over a decade of research and development, Kuraray Company has established PVA gel beads as an effective biological wastewater treatment technology.

PVA (polyvinyl alcohol) gel is a porous hydrogel that is ideally suited for immobilization of microorganisms essential for the degradation of environmental pollutants.

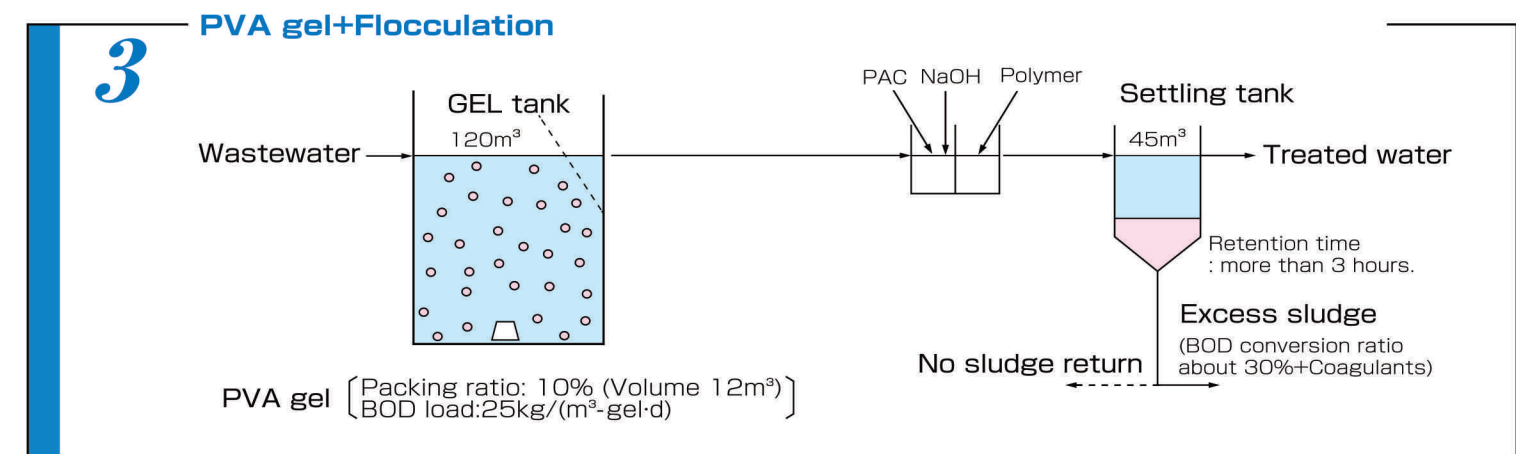
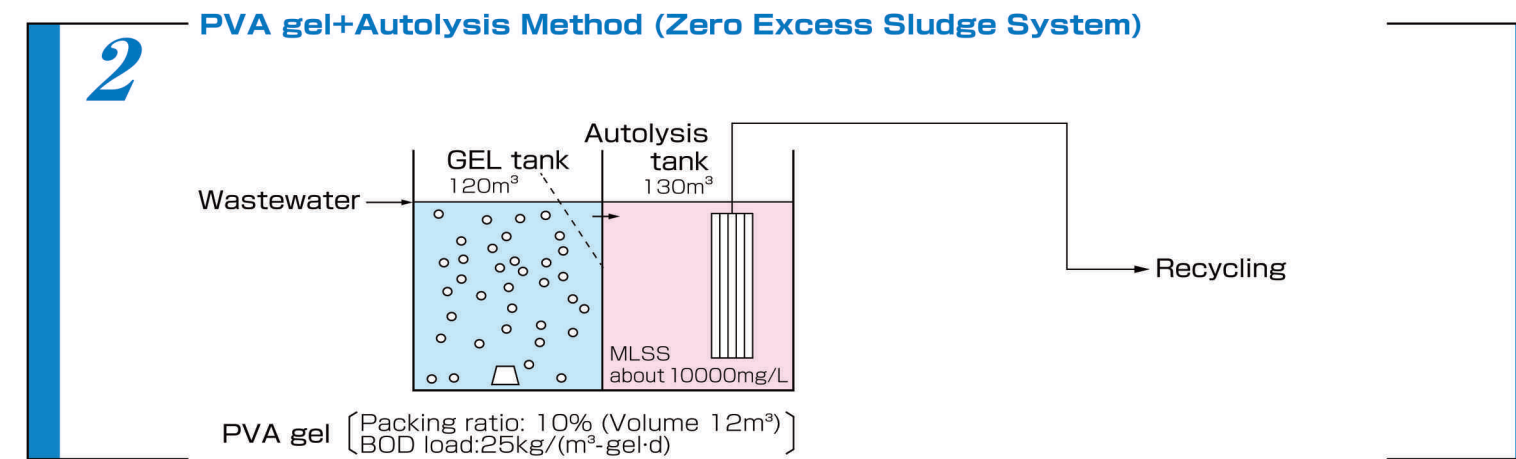
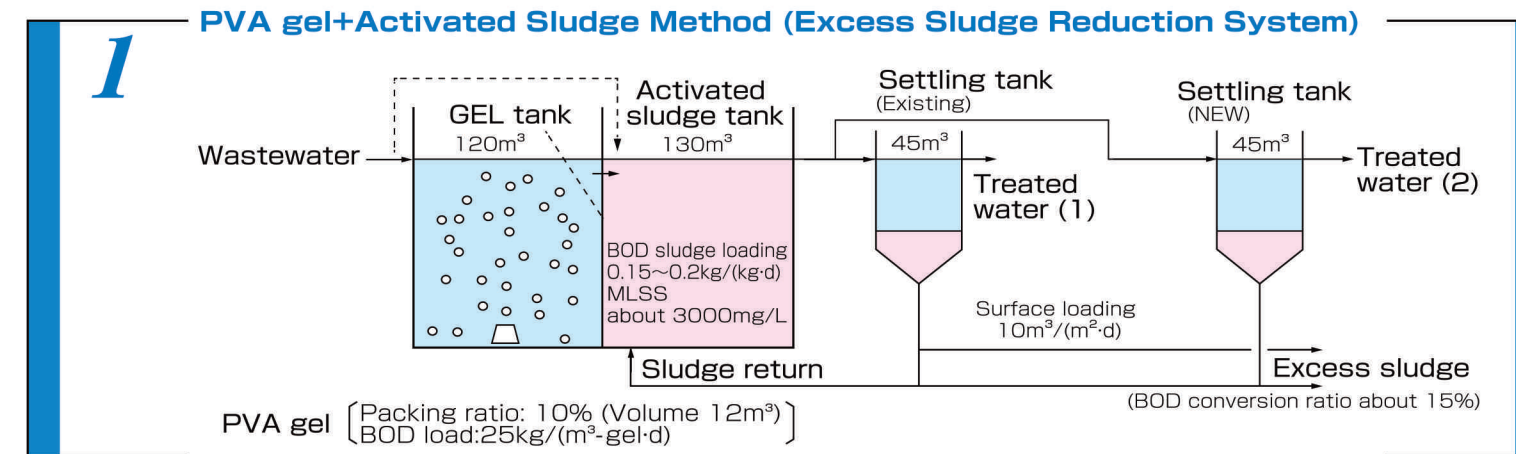
Advantages of PVA gel beads:

- 1 PVA gel is formed as **4mm** spherical beads having a specific gravity of about 1.02 and thus excellent fluidity in water requiring minimal energy for mixing.
- 2 PVA gel has a network of minute pores about **20 microns** in diameter tunneling through each bead. Useful bacteria can thus be enriched in large numbers in the protective core of the beads greatly reducing sloughing of biomass while maintaining stable treatment efficiencies often at rates in excess of **25kg BOD/(m³-gel-d.)**
- 3 PVA gel treatment yields less excess sludge as compared to conventional biological methods.
- 4 PVA gel has a very high water content due to its extensive porosity, thus allowing for favorable permeability of oxygen and nutrients to the bacteria colonized inside the beads.
- 5 Polymerized PVA gel is essentially insoluble in water and is not known to be biodegradable.
- 6 Depending on the characteristics of the wastewater, treatment ability using PVA gel can be enhanced up to **5 times** that of conventional activated sludge, thus allowing for upgrading of existing overloaded systems or for design of new process units with greatly reduced footprints.
- 7 In addition to removal of common organic compounds (BOD cut), PVA gel can also be used for **nitrification and denitrification** as well as treatment of various industrial pollutants.
- 8 PVA gel has a surface area of **2,500 m²/m³**, no other bio-carrier comes close. This large surface area allows us to treat waters with a high level of contamination or to reduce the foot print of the treatment tanks. Less HRT, less space, less cost, more treatment.

Examples of wastewater treatment using PVA gel beads

1. Treatment for BOD removal

In the following example, an existing wastewater treatment plant is considered that has a 250m³ activated-sludge tank and a 45m³ clarifier. The plant was originally designed to handle 150m³/d with an influent BOD₅ of 1,000mg/L. However, the plant is now in need of an upgrade to handle an increased flow of 300m³/d (with the same BOD₅), for which three design options are shown below. A conventional activated-sludge system would require about twice the existing tank volumes to treat the increased loading (not shown).

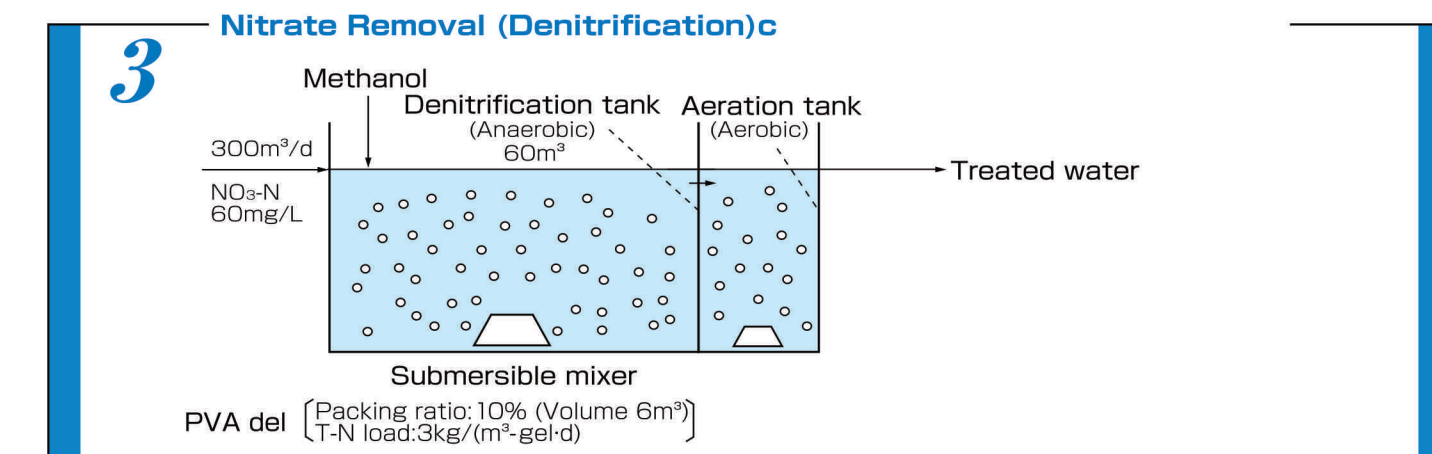
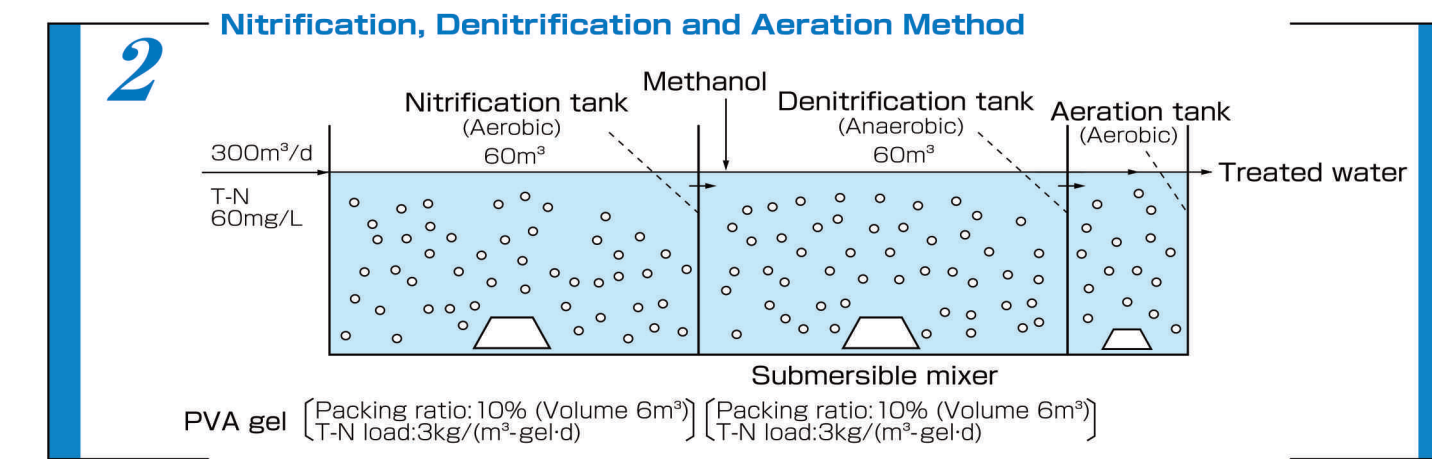
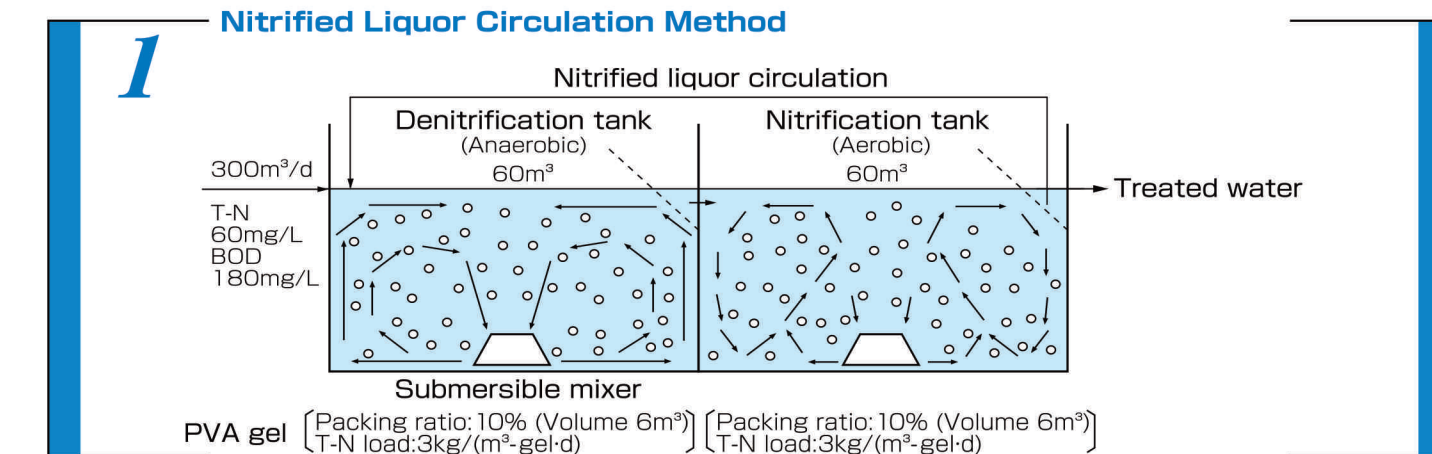


Notes ●The flow diagrams shown here are only typical examples for BOD removal and no performance guarantees are implied. System performance may vary based on various environmental factors and wastewater characteristics.
●Submersible mixers and appropriate aeration equipment shall be used for fluidization of gel and oxygen supply (when needed), respectively.
●When submersible switch mixers are used, a minimum clearance of 5mm shall be maintained between the impeller and its casing.

2. Treatment for nitrogen removal

In the following example, an influent wastewater flow of 300m³/d is considered with total nitrogen (T-N) of 60mg/L. Three design options are shown.

- ★Nitrification reaction (aerobic) Ammonia-form nitrogen is converted to nitrite and then nitrate (requiring sufficient dissolved oxygen and minimal interference from organic carbon).
- ★Denitrification reaction (anoxic) Nitrate is converted to nitrite and then nitrogen gas (requiring sufficient organic carbon and minimal interference from dissolved oxygen).



Notes ●The flow diagrams shown here are only typical examples for nitrogen removal and no performance guarantees are implied. System performance may vary based on various environmental factors and wastewater characteristics.
●Submersible mixers and appropriate aeration equipment shall be used for fluidization of gel and oxygen supply (when needed), respectively.
●When submersible switch mixers are used, a minimum clearance of 5mm shall be maintained between the impeller and its casing.