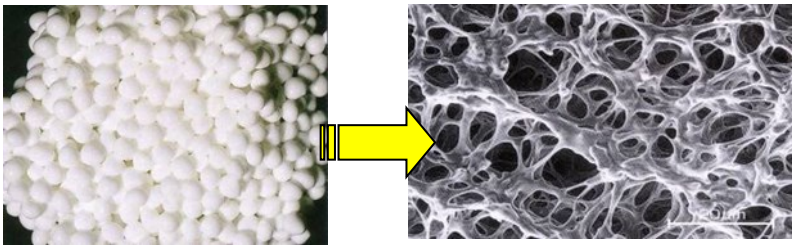
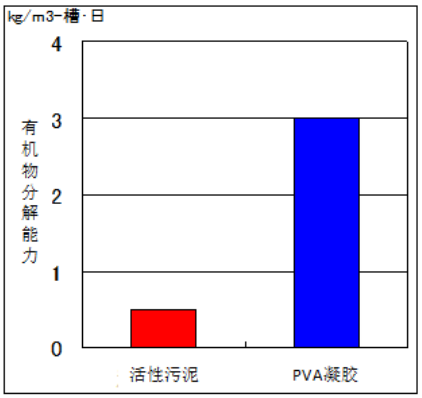
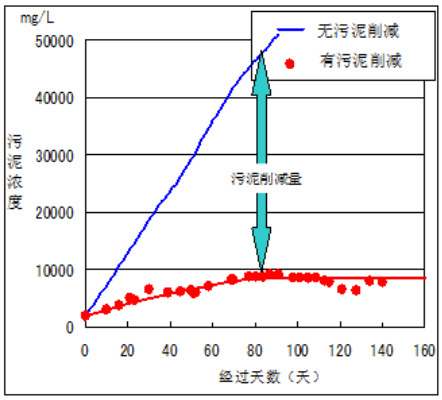
日期　2020 年 8 月 5 日

<table>
<tr><td>公司，机构名称</td><td colspan="4">株式会社可乐丽
英文名：KURARAY CO.,LTD.</td></tr>
<tr><td>技术，设备名称</td><td colspan="4">废水处理用 PVA 凝胶</td></tr>
<tr><td rowspan="4">分类</td><td></td><td>（１）节能</td><td>○</td><td>（５）水治理</td></tr>
<tr><td></td><td>（２）新能源</td><td></td><td>（６）土壤污染治理</td></tr>
<tr><td></td><td>（３）大气污染治理</td><td></td><td>（７）智慧城市</td></tr>
<tr><td></td><td>（４）循环经济</td><td></td><td>（８）其他</td></tr>
<tr><td>特点（宣传亮点）</td><td colspan="4">细菌固定载体<KURAGEL>以聚乙烯醇（PVA）为原料制作而成，呈白色细小的球状。它具有极细的网状结构，1 粒凝胶内部生长增殖的微生物可达 10 亿个之多，其职责就是通过微生物的作用让产业、生活废水变干净，重回自然。</td></tr>
<tr><td>节能环保效果和经济效益</td><td colspan="4">◆以生物亲和性高的聚乙烯醇（PVA）为原料，微生物的生长增殖性良好，与传统的活性污泥法相比，可大幅提高微生物浓度，因此通过集约型的设备即可有效去除 BOD 和氮。
◆通过整体系统设计，在运行过程中几乎不产生剩余污泥。

＜KURAGEL ™＞
直径 4mmφ的球状体　　电子显微镜下的照片


A 工厂（化学废水、BOD 500mg/L）



</td></tr>
<tr><td>技术设备概要和原理</td><td colspan="4"></td></tr>
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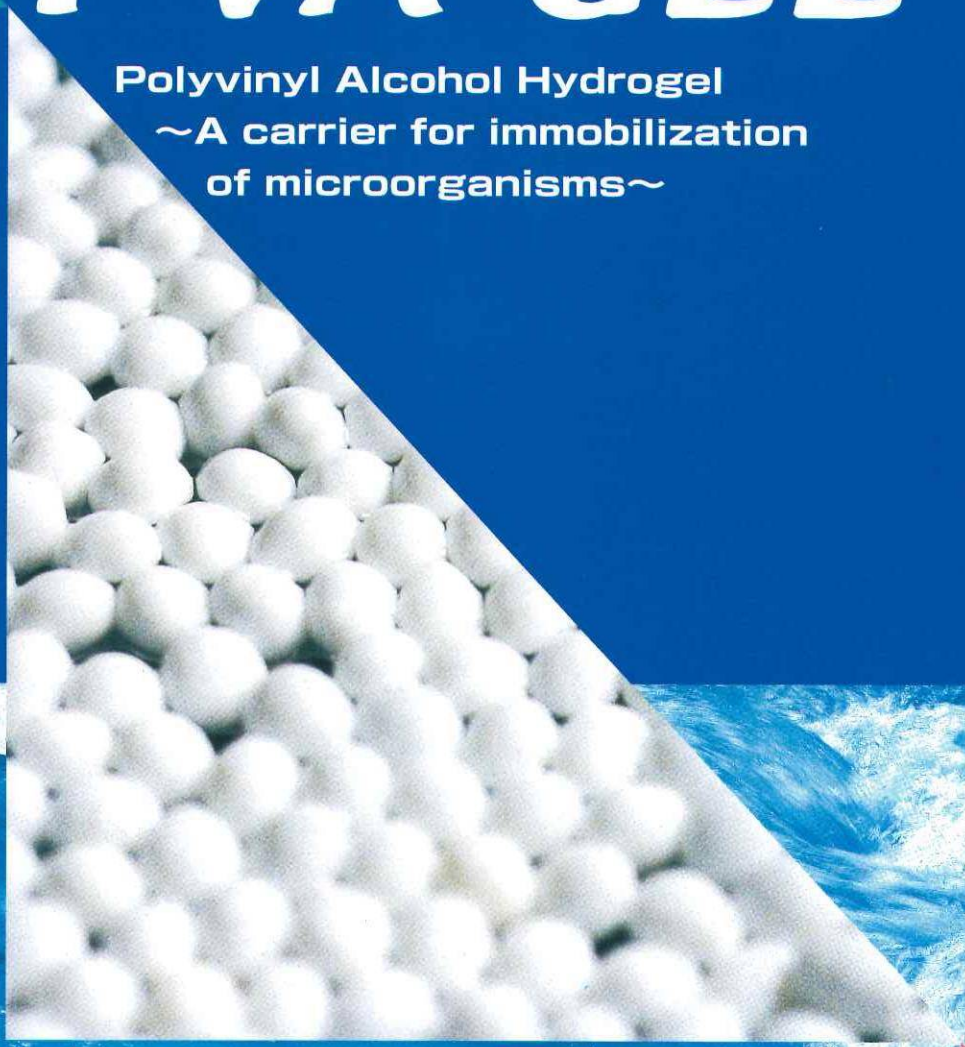
业绩	以日本国内市场为主，在电子半导体、汽车机械、化学医疗、食品酿造等行业业绩斐然。

在华联系方式	联系人：石原　裕久（可乐丽国际贸易（上海）有限公司） TEL：021-61198111 E-mail：Hirohisa.Ishihara@kuraray.com 〒200030 上海市徐汇区虹桥路 3 号 港汇中心二座 2207 单元
在日本的联系方式	联系人：成重　大知（可乐丽水处理株式会社 销售部） TEL：+81-3-6701-1561 E-mail：Daichi.Narishige@kuraray.com 〒100-8115 东京都千代田区大手町 1-1-3 大手中心大厦
网址	https://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/(m^3-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 know 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.

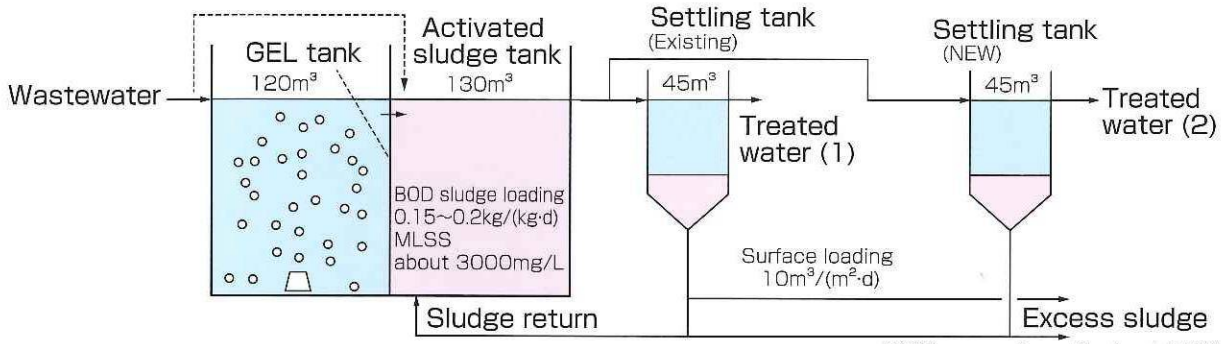
7 In addition to removal of common organic compounds (BOD cut), PVA gel can also be used for nitrification and denitrification as well as treatment of various industrial pollutants.

Examples of wastewater treatment using PVA gel beads

1.Treatment for BOD removal

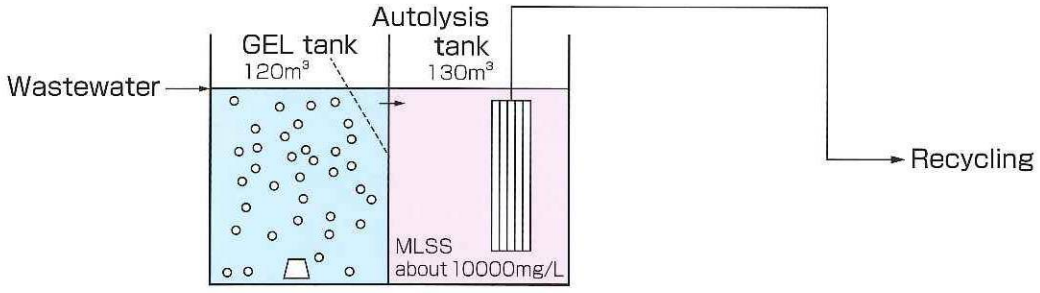
In the following example, an existing wastewater treatment plant is considered that has a 250m³ activated-sludge tank and a 45m³ clarifier. The plant was originally designed to handle 150m³/d with an influent BOD_5 of 1,000mg/L. However, the plant is now in need of an upgrade to handle an increased flow of 300m³/d (with the same BOD_5), 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).

1 PVA gel+Activated Sludge Method (Excess Sludge Reduction System)



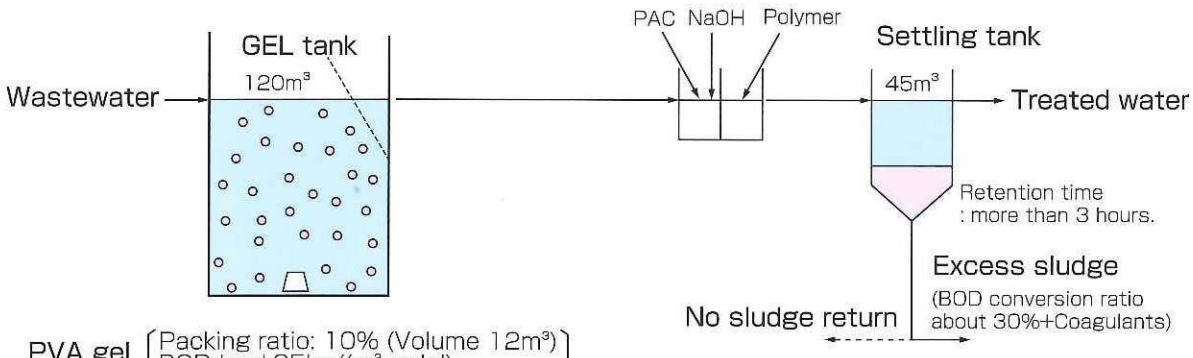
PVA gel { Packing ratio: 10% (Volume 12m³) / BOD load:25kg/(m³-gel·d) }

2 PVA gel+Autolysis Method (Zero Excess Sludge System)



PVA gel { Packing ratio: 10% (Volume 12m³) / BOD load:25kg/(m³-gel·d) }

3 PVA gel+Flocculation



PVA gel { Packing ratio: 10% (Volume 12m³) / BOD load:25kg/(m³-gel·d) }

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.

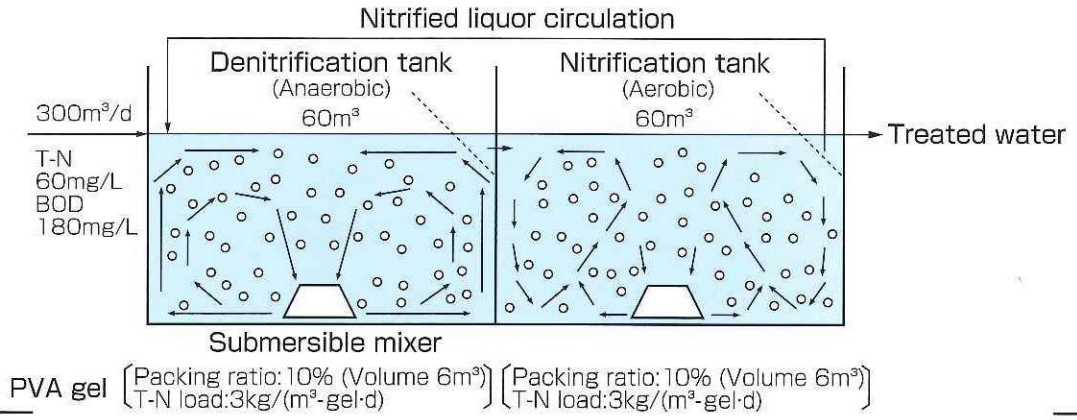
2.Treatment for nitrogen removal

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).

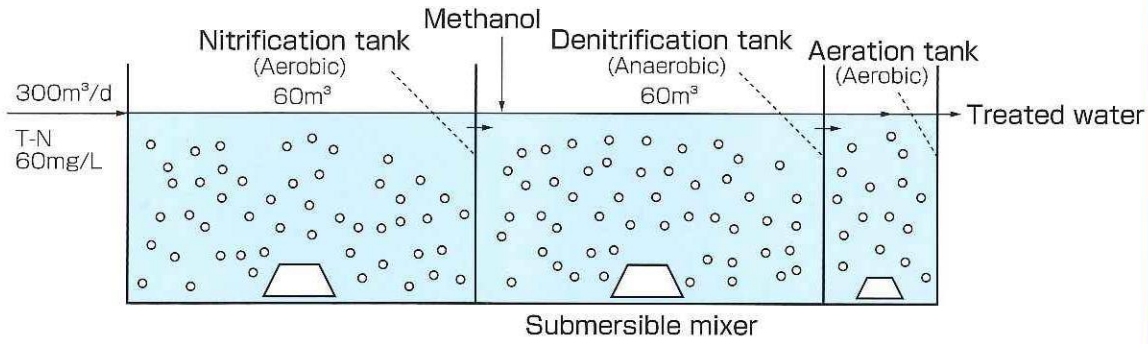
★Denitrification reaction (anoxic) Nitrate is converted to nitrite and then nitrogen gas (requiring sufficient organic carbon and minimal interference from dissolved oxygen).

1 Nitrified Liquor Circulation Method



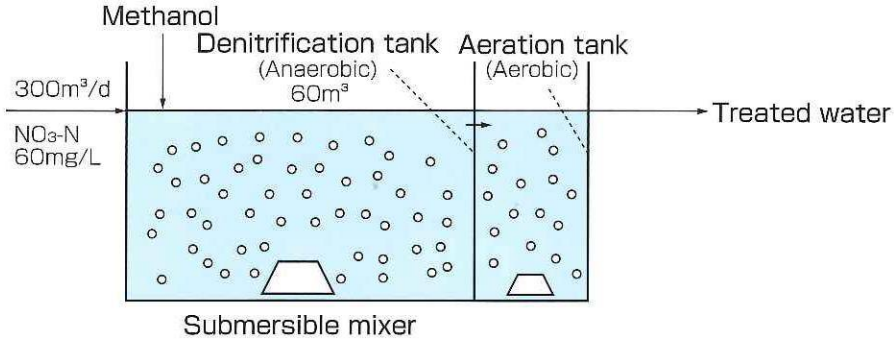
PVA gel [Packing ratio: 10% (Volume 6m³) T-N load:3kg/(m³-gel·d)] [Packing ratio: 10% (Volume 6m³) T-N load:3kg/(m³-gel·d)]

2 Nitrification, Denitrification and Aeration Method



PVA gel [Packing ratio: 10% (Volume 6m³) T-N load:3kg/(m³-gel·d)] [Packing ratio: 10% (Volume 6m³) T-N load:3kg/(m³-gel·d)]

3 Nitrate Removal (Denitrification)c



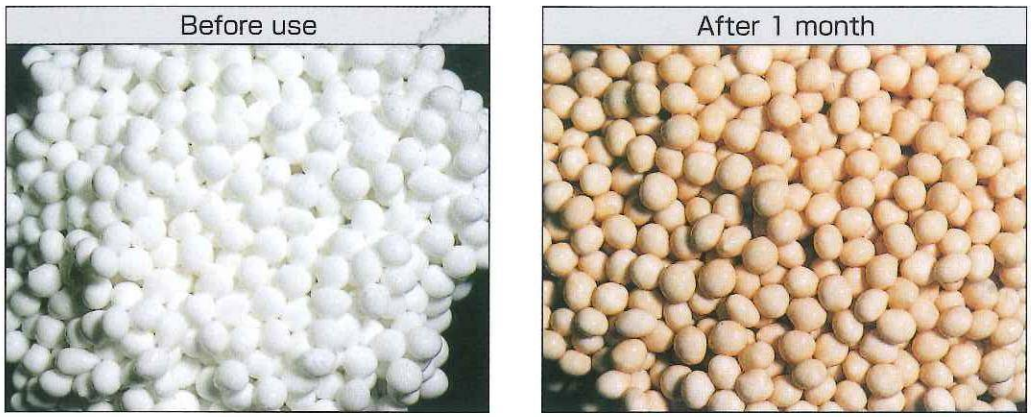
PVA del [Packing ratio: 10% (Volume 6m³) T-N load:3kg/(m³-gel·d)]

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.

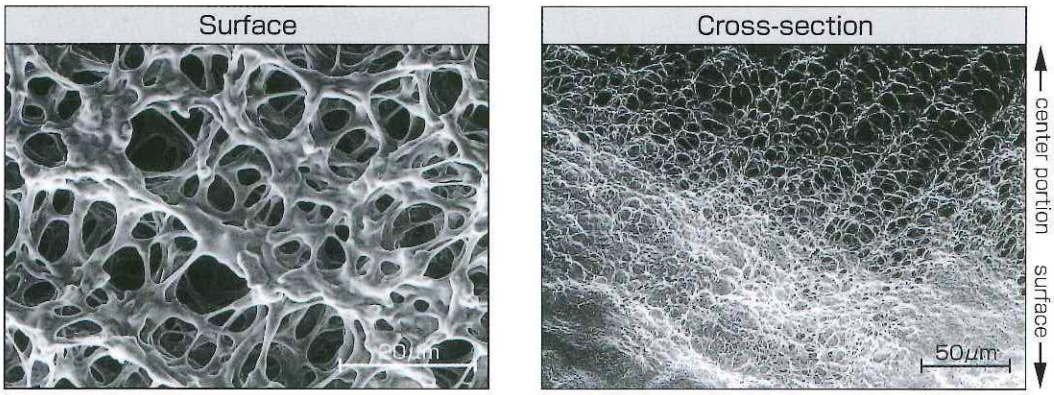
●When submersible switch mixers are used, a minimum clearance of 5mm shall be maintained between the impeller and its casing.

【Appearance of PVA gel】



【Microscopic structure of PVA gel】

Photograph taken with an Environmental Scanning Electron Microscope (ESEM)

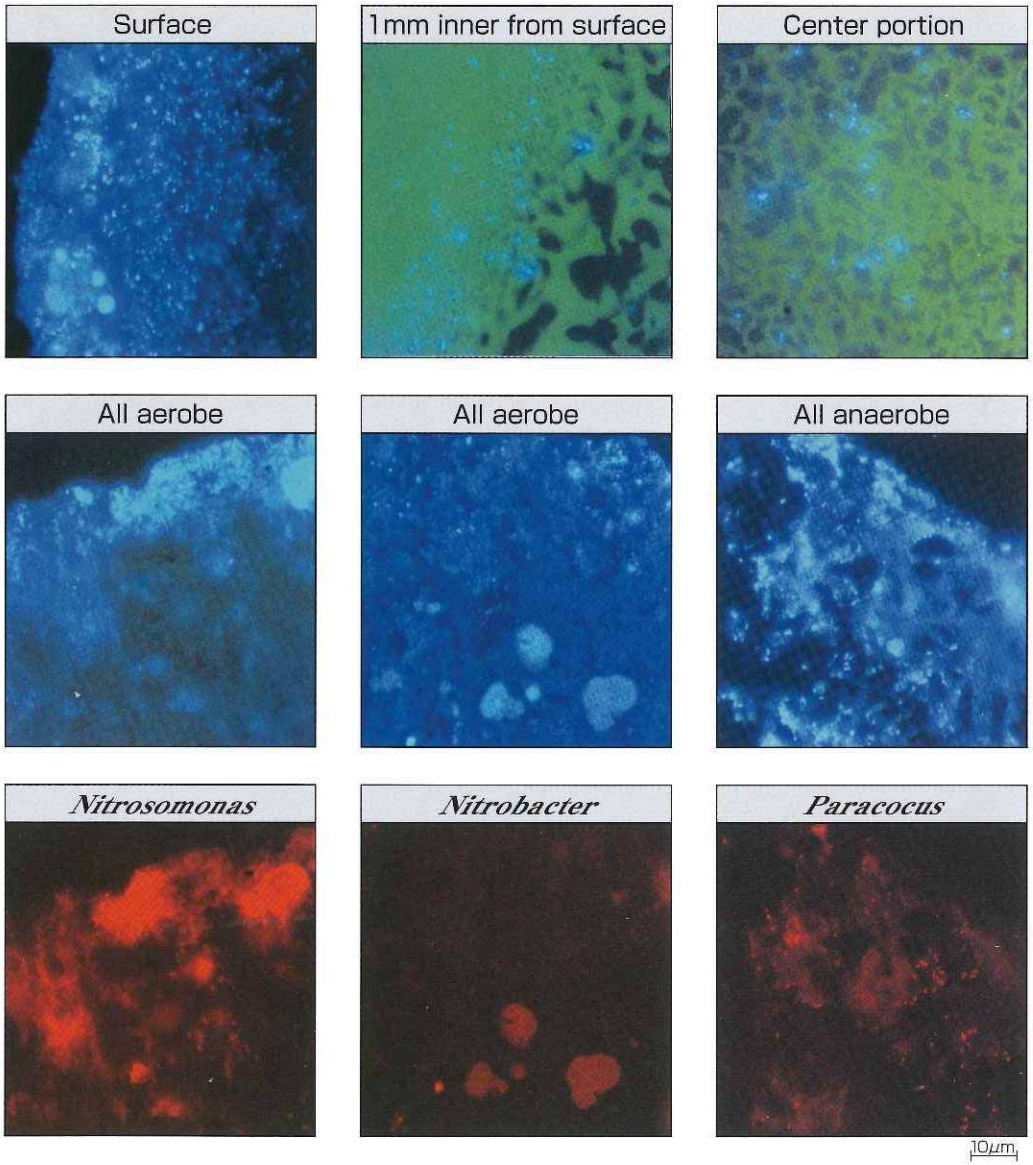


【Distribution of Bacteria】

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/m^3·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

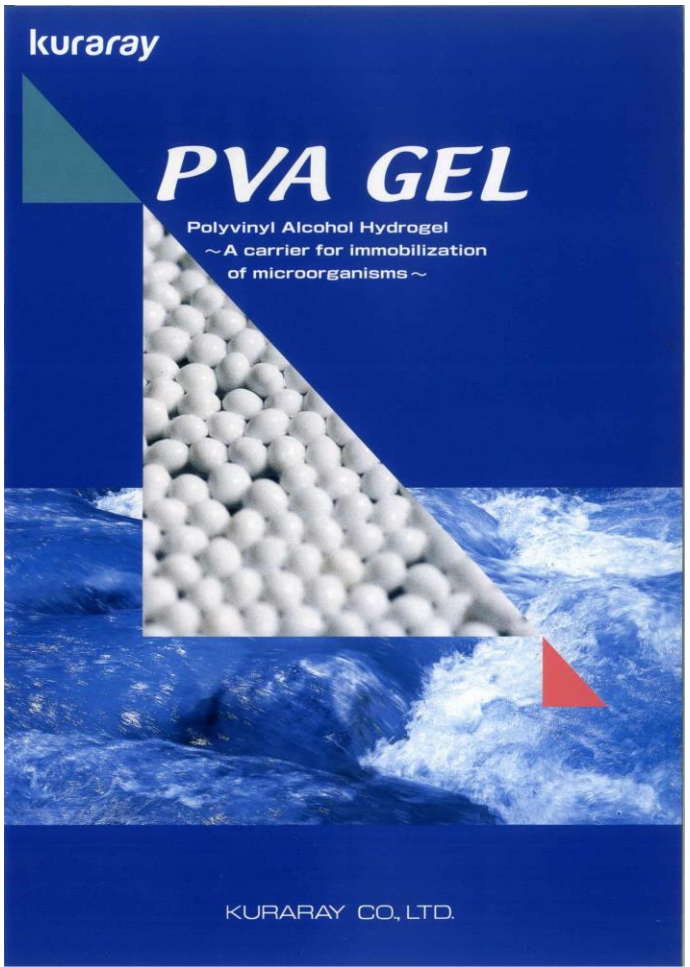
- ●PVA gel beads are a slipping hazard when spilled on walking surfaces.
- ●The water used for packing PVA gel during storage and shipping may be slightly acidic, thus wash thoroughly after contact with skin.
- ●If the packing water gets in eyes, wash eyes thoroughly with clean water and consult a physician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

KURARAY CO., LTD.

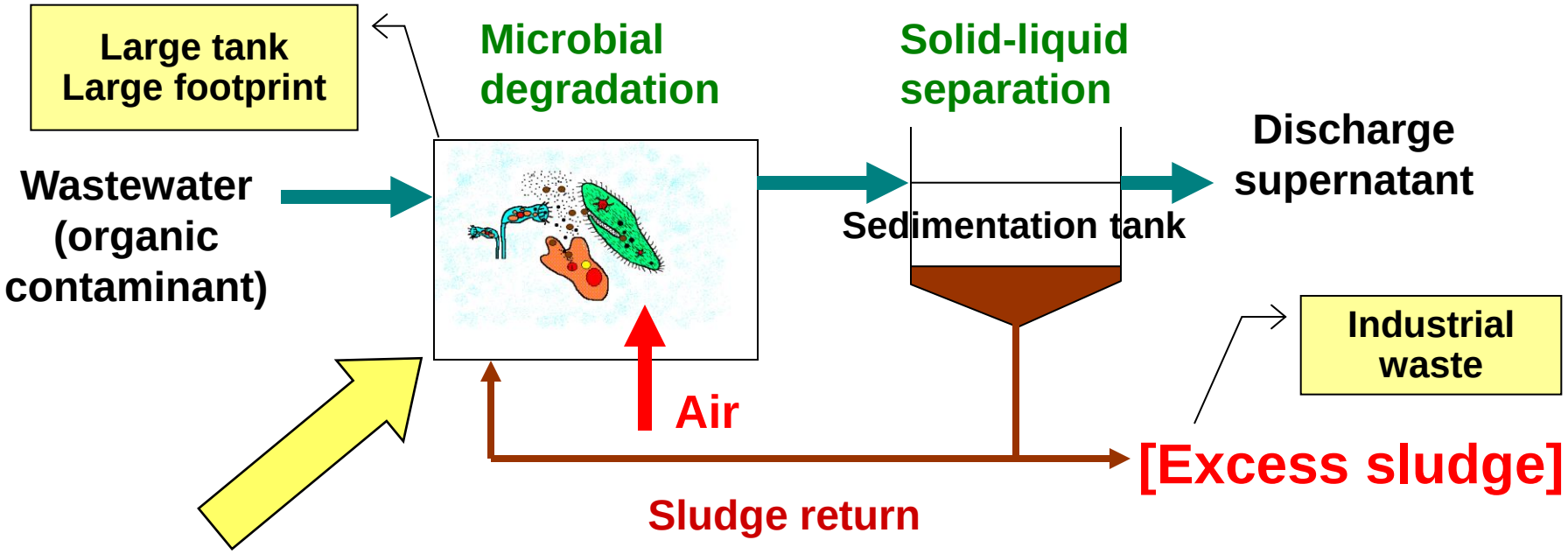
Environmental Business Development and Promotion Division
OTE CENTER BLDG., 1-1-3. Otemachi, Chiyoda-ku, Tokyo 100-8115, Japan
TEL:+81-3-6701-1550 FAX:+81-3-6701-1654
http://www.kuraray.co.jp/

Selling agency :

PVA Gel Beads
For Biological Wastewater Treatment



Conventional Biological Wastewater Treatment



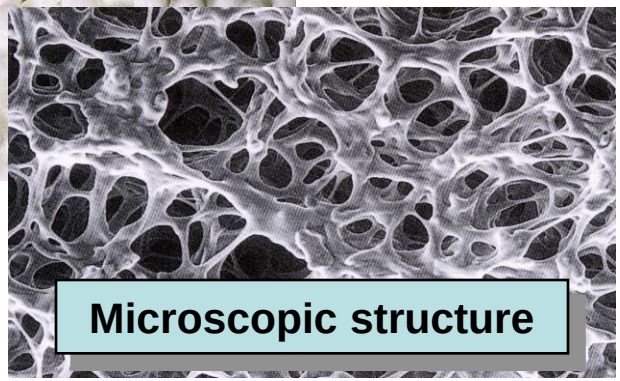
Activated sludge ("sludge" is the mixture of bacteria, protozoa and metazoa.)

Microorganisms grow by eating organic substances (about 50% of organic substances (BOD) converts to CO_2/ H_2O and the rest converts to excess sludge). The excess sludge must be discharged periodically.

PVA-gel Beads as Bio-carrier

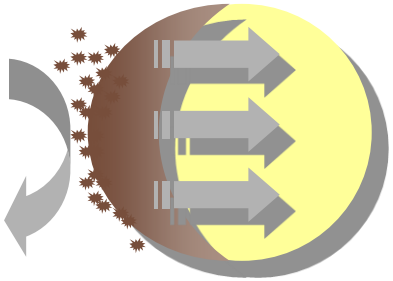


Material: Polyvinyl alcohol (PVA)
Size: 5mmΦ beads
Specific gravity: 1.015



Microscopic structure





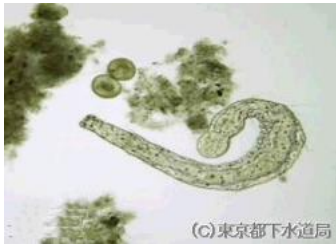
Protozoa, Metazoa

Only bacteria can enter into PVA Gel.









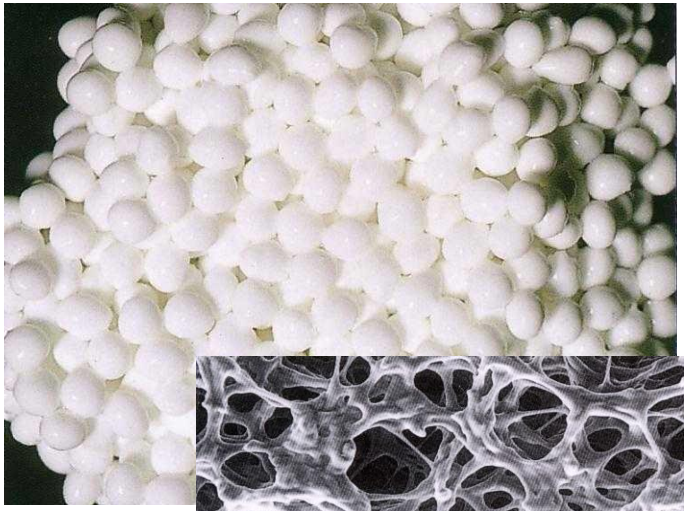
1 μm　10 μm　100 μm　1,000 μm

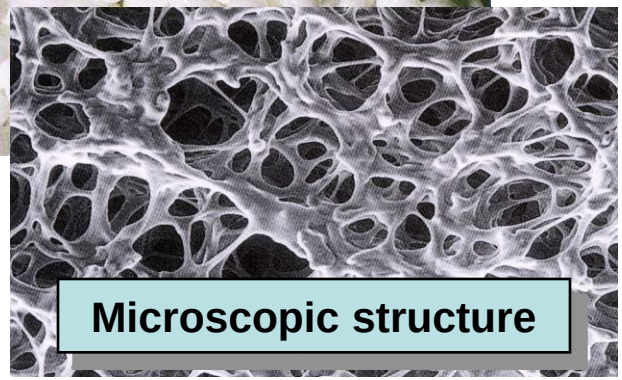
Bacteria
Several μm

Size of micro pores on the surface of the PVA Gel
5～20 μm

Protozoa, Metazoa

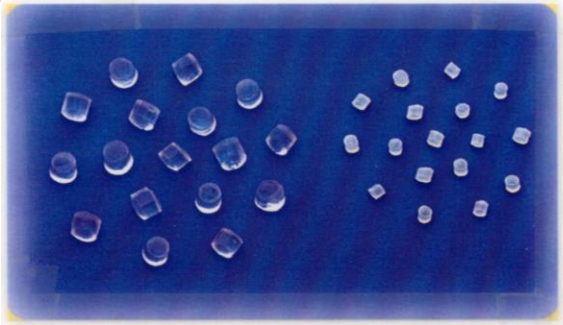
Examples of bio-carriers

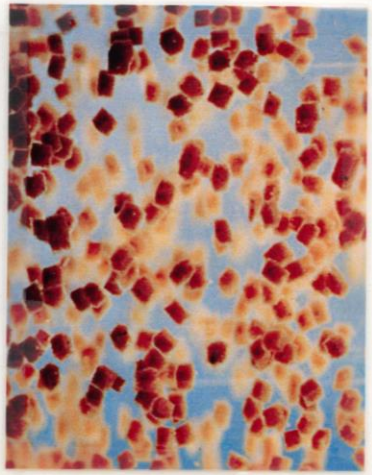




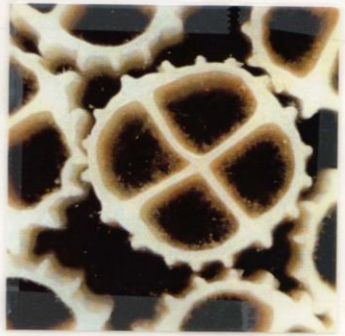
Kuraray PVA-Gel

Unlike PVA gel beads, most of the other carriers do not have porous structures, thus can only retain bacteria on their surface.

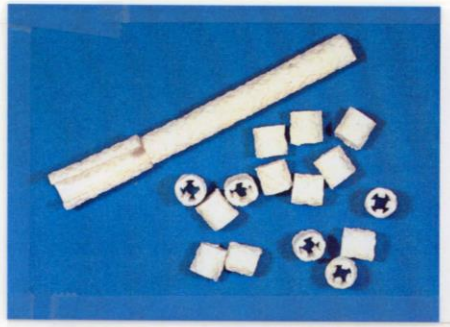












Feature of wastewater treatment using PVA-Gel

1. *Quite high load is possible.*
   (5 times or higher than conventional activated sludge)

2. *PVA-gel can also be used for biological nitrification and denitrification processes.*

3. *The amount of excess sludge can be reduced.*
   (We have some special techniques to reduce excess sludge dramatically with PVA-gel.)

Comparison of Capability

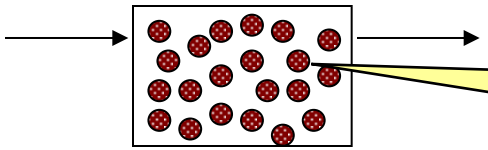
Conventional system

Mixture of Bacteria, protozoa, metazoa, etc.

Activated sludge tank

Tank volume can be reduced to 1/6, or volume load can be increased by 6 times

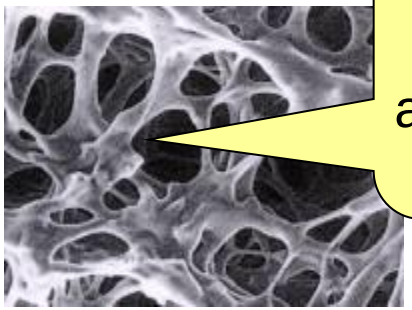
PVA gel (10 % vol. packing)



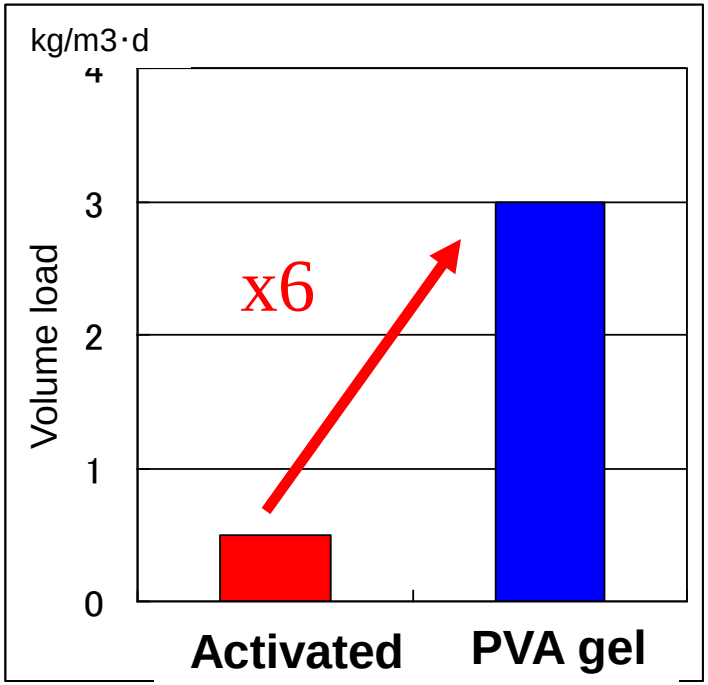
Only effective bacteria

PVA gel tank

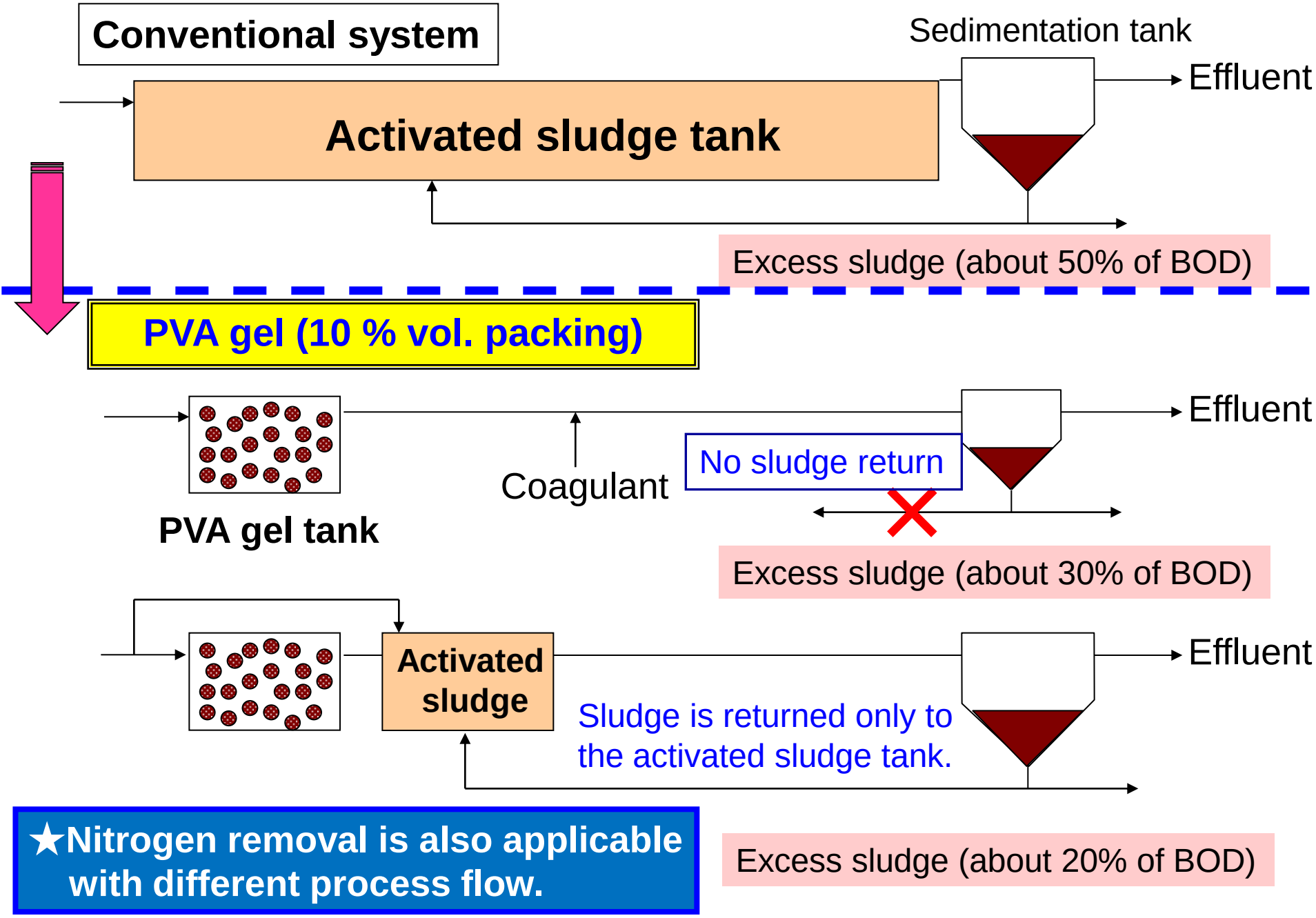




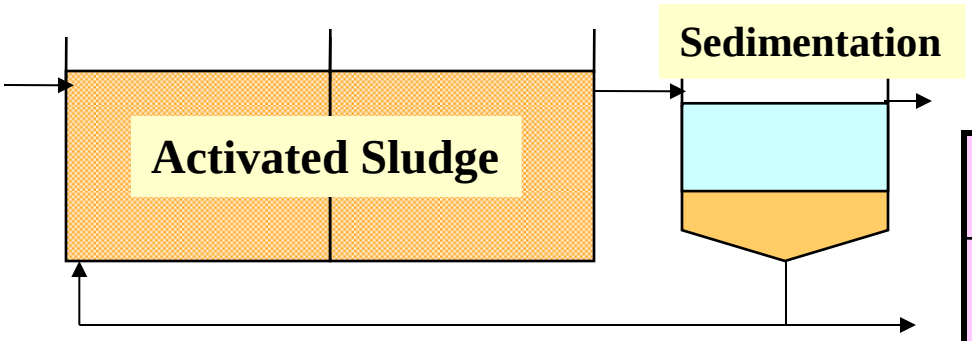
Countless bacteria are retained in PVA gel.



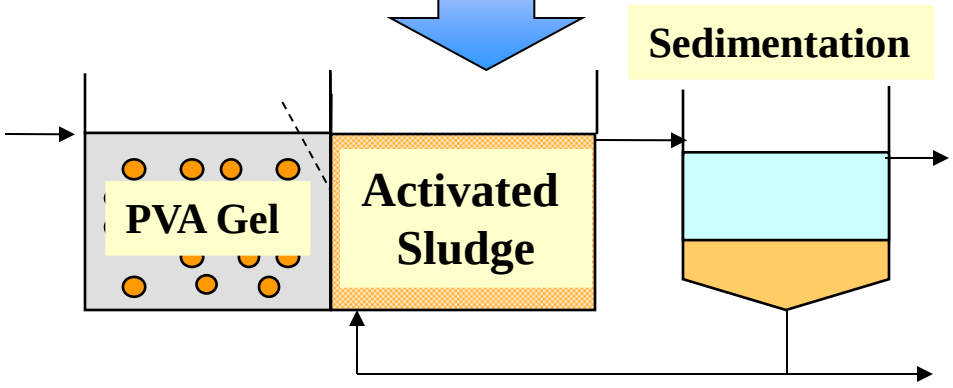
High Efficiency and Low Excess Sludge



Installation Example (1) Food factory (BOD removal)



Increase the capacity of BOD removal with no tank expansion.



- Increase the capacity of BOD removal
- Reduction of excess sludge

	Before	After	
Flow rate [m^3/d]	50	50	–
Volume load [$kg/m^3/日$]	0.5	1.2	2.4 times
BOD of effluent [mg/L]	180	< 30	–
Excess sludge [m^3/Y]	2470	740	1/3

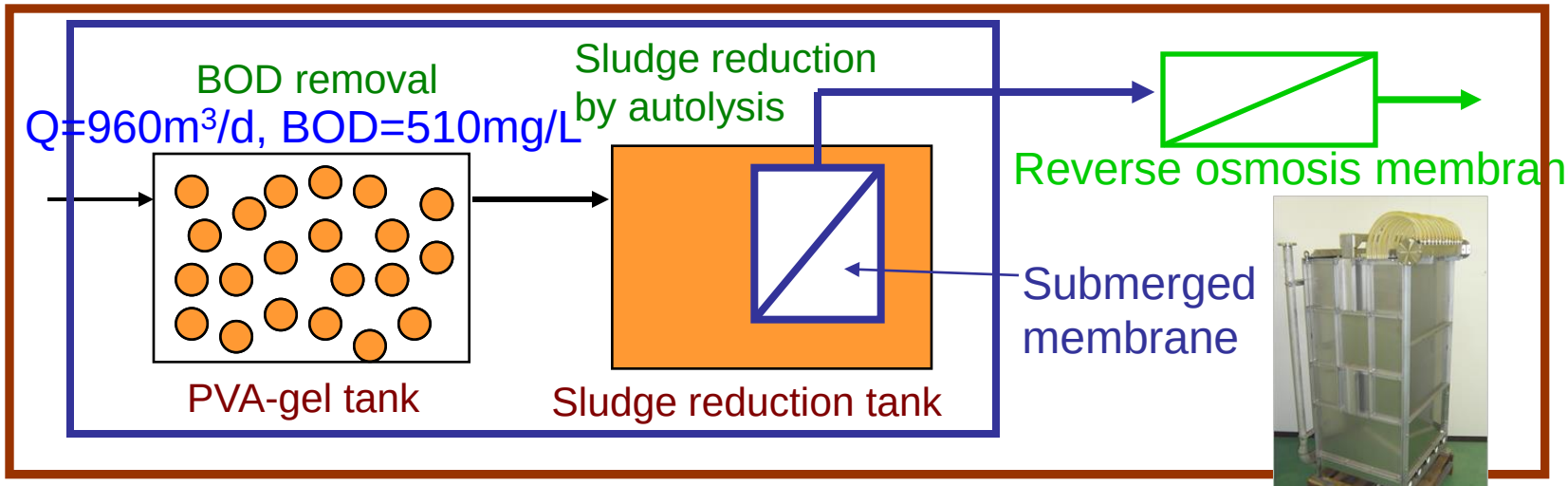
Installation Example (2) Recycle of the wastewater as ultra pure water and sludge reduction (Taiwan)



Reverse osmosis membrane

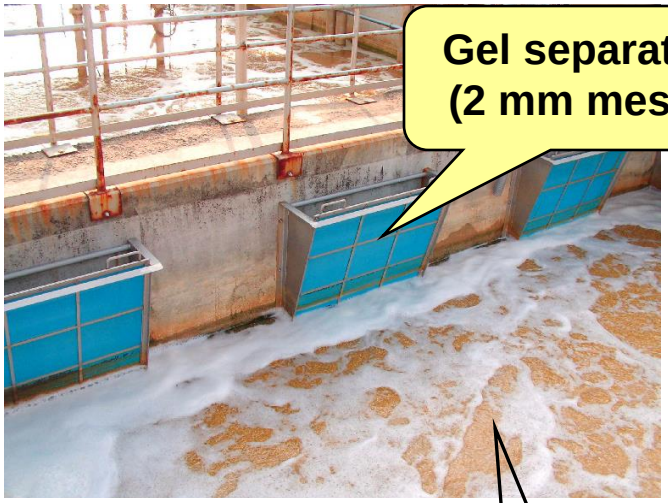
PVA-gel beads + sludge reduction (installed underground)

- 85% of the wastewater can be recycled as ultra pure water.
- Greatly reduced excess organic sludge by autolysis.

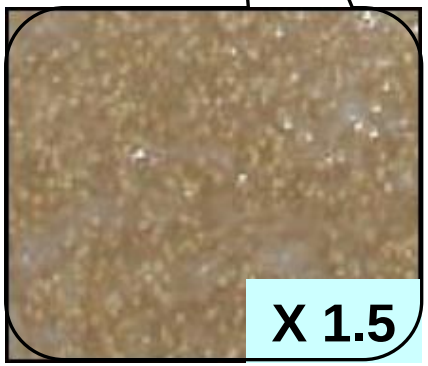


Installation Example (3): Sludge Reduction System

Kuraray Saijo Plant (400m^3/d)



PVA Gel tank (BOD removal)



BOD removal and sludge reduction

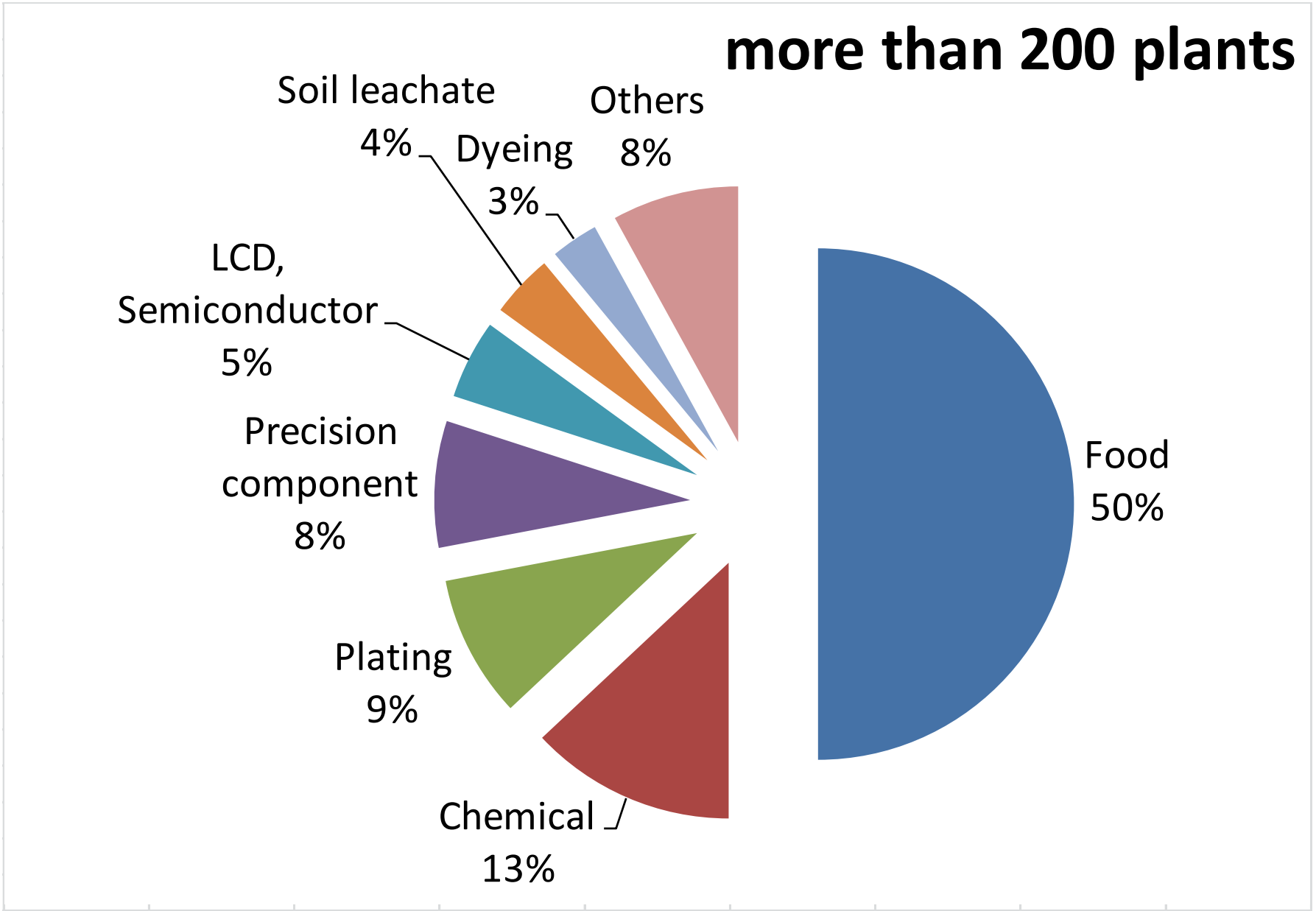


Sludge reduction tank



Sedimentation tank

Delivery record of PVA-Gel for each industry sector



Overseas bases & Global launch of PVA-Gel

