

---

---

**The Study of Membrane Fouling Reduction and  
Organic Substance Removal Efficiency with Use  
of the Biodegradation, Activated Charcoal  
Absorption for Drinking Water Treatment**

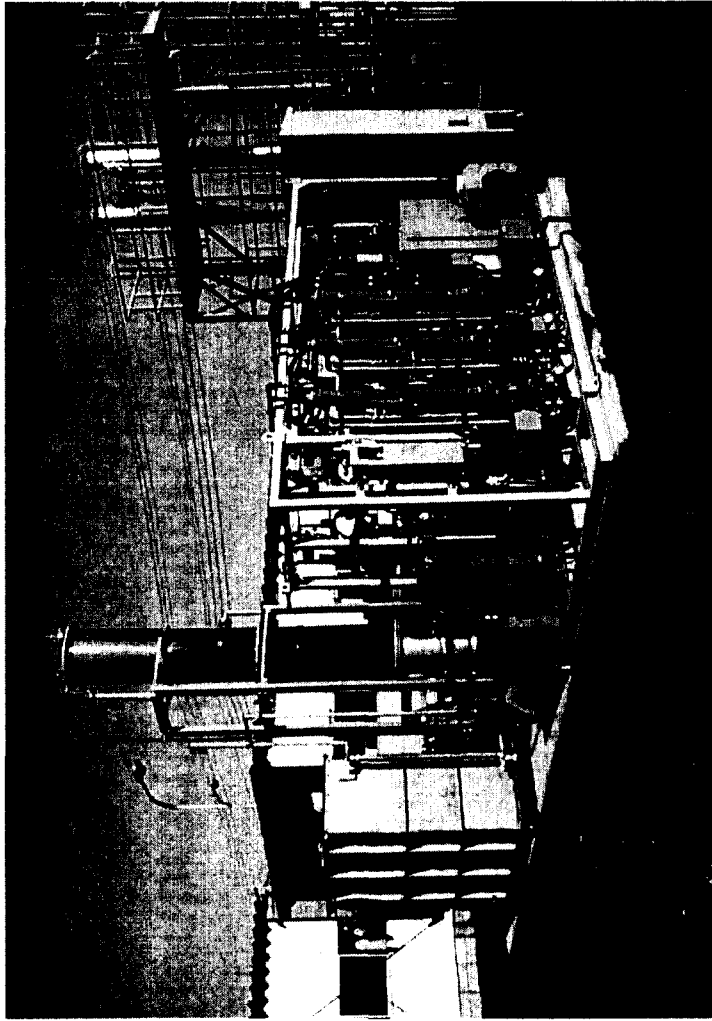
---

---



Kazue Shibata  
(Sanki Eng., Co.)

**The Study of Membrane Fouling Reduction and  
Organic Substance Removal Efficiency with  
use of the Biodegradation , Activated  
Charcoal Absorption for Drinking Water Treatment.**



**The Membrane Society of Korea  
Work Shop Presentation  
July 26, 2001  
in YongPyong Resort**

**Kazue Shibata  
Environmental Systems  
Administration Division,  
SANKI Engineering Co., Ltd.**

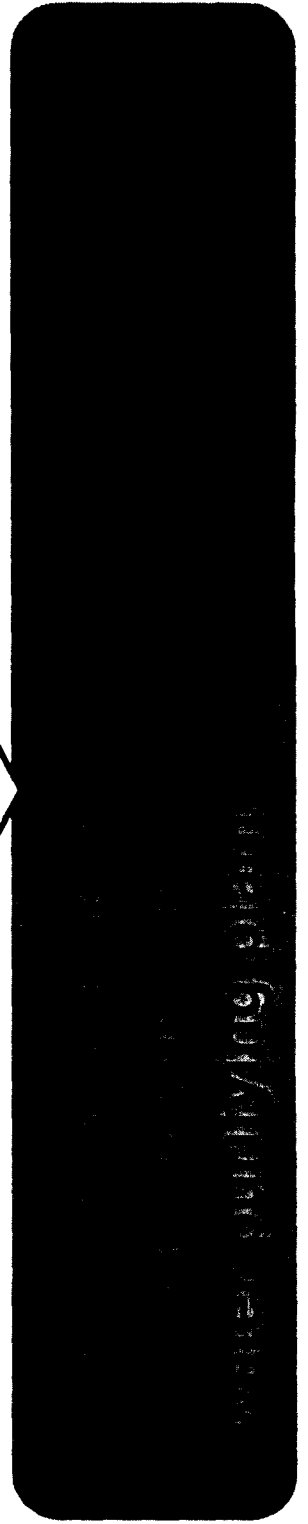
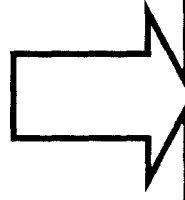
## **Outline**

- ◆ **Introduction**
- ◆ **Experimental Method**
- ◆ **Pretreatment and Membrane filtration with use of the biological activity charcoal**
- ◆ **Membrane filtration of the water with addition of powder active carbon**
- ◆ **Assumption of the membrane fouling material**
- ◆ **Summary**

## **Introduction**

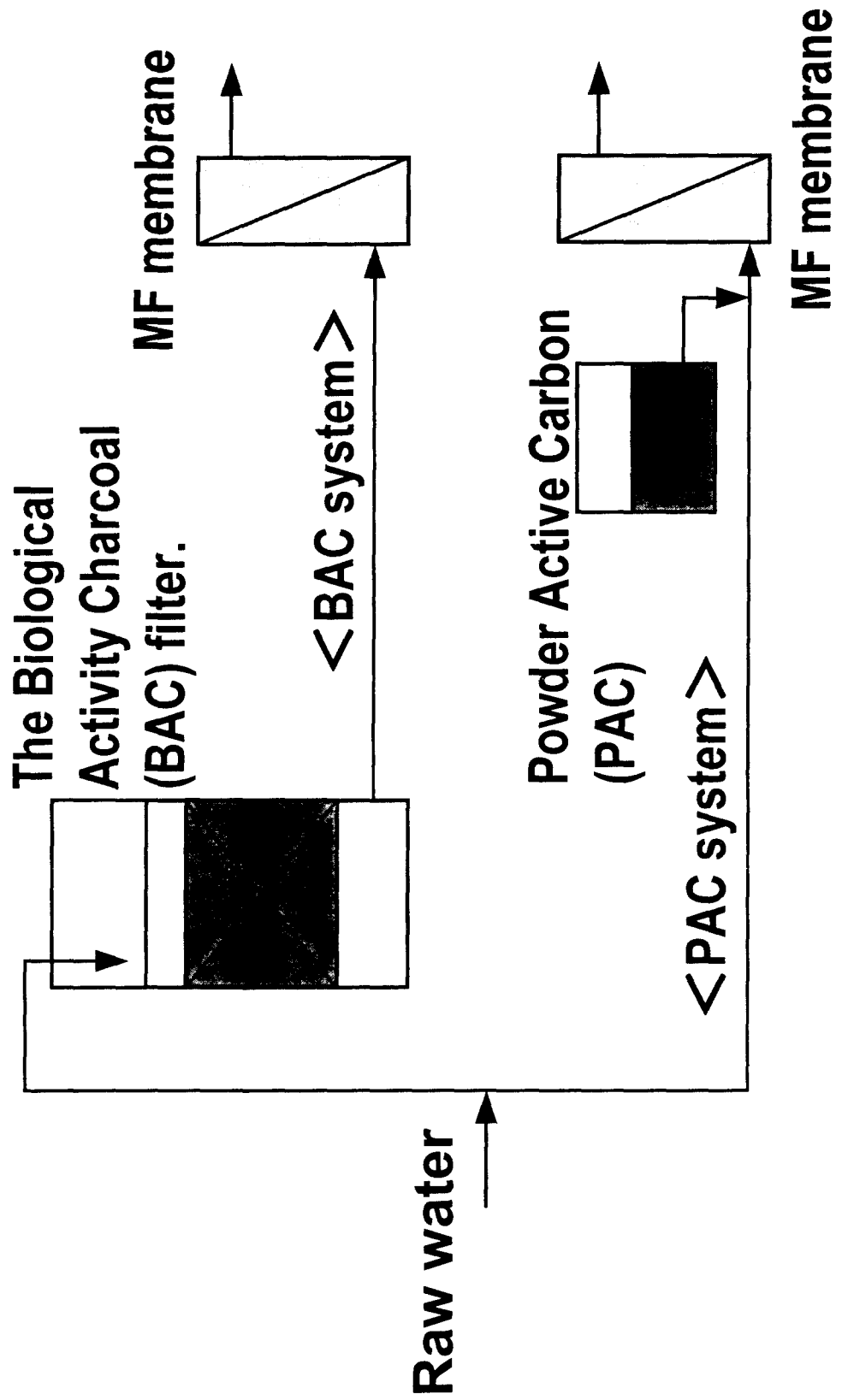
---

- ◆ **In the urban area , people worry about water source pollution by Organic Substance.**
  - ◆ **It is difficult that the dissolved organic matter is removed only by the membrane filtration.**
  - ◆ **It is important that the membrane is frequently cleaned by medical.**
- **It is important to reduce the Membrane Fouling.**



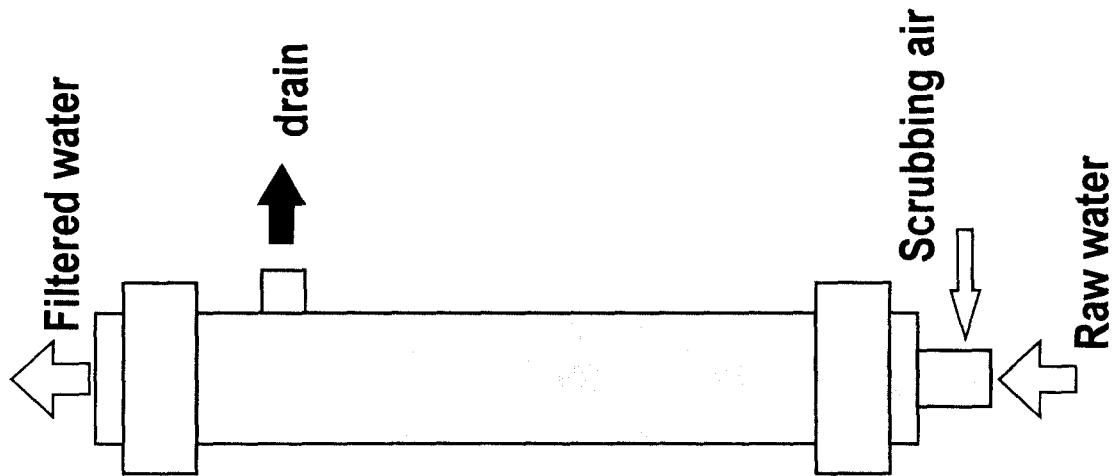
**Experiment**

**Membrane fouling effect of decreasing was examined by carrying out 2 kinds of pretreatment for the raw water.**



**Experiment**

**The membrane filtration flux was 1.0 m/day , and deadend filtration of the constant flow was carried out.**



**Specifications of the membrane and operational sequence**

<b>style</b>	<b>external pressure style hollow fiber module</b>
<b>material</b>	<b>Polyvinilidene fluoride</b>
<b>nominal pore size</b>	<b>0.1 <math>\mu</math> m</b>
<b>membrane surface area</b>	<b>7.0 m<sup>2</sup></b>
<b>filtration method</b>	<b>deadend filtration of the constant flow</b>
<b>flux</b>	<b>1.0 m/day</b>
<b>physical washing</b>	<b>back-pressure washing and air-scrubbing , once in 30 minutes</b>

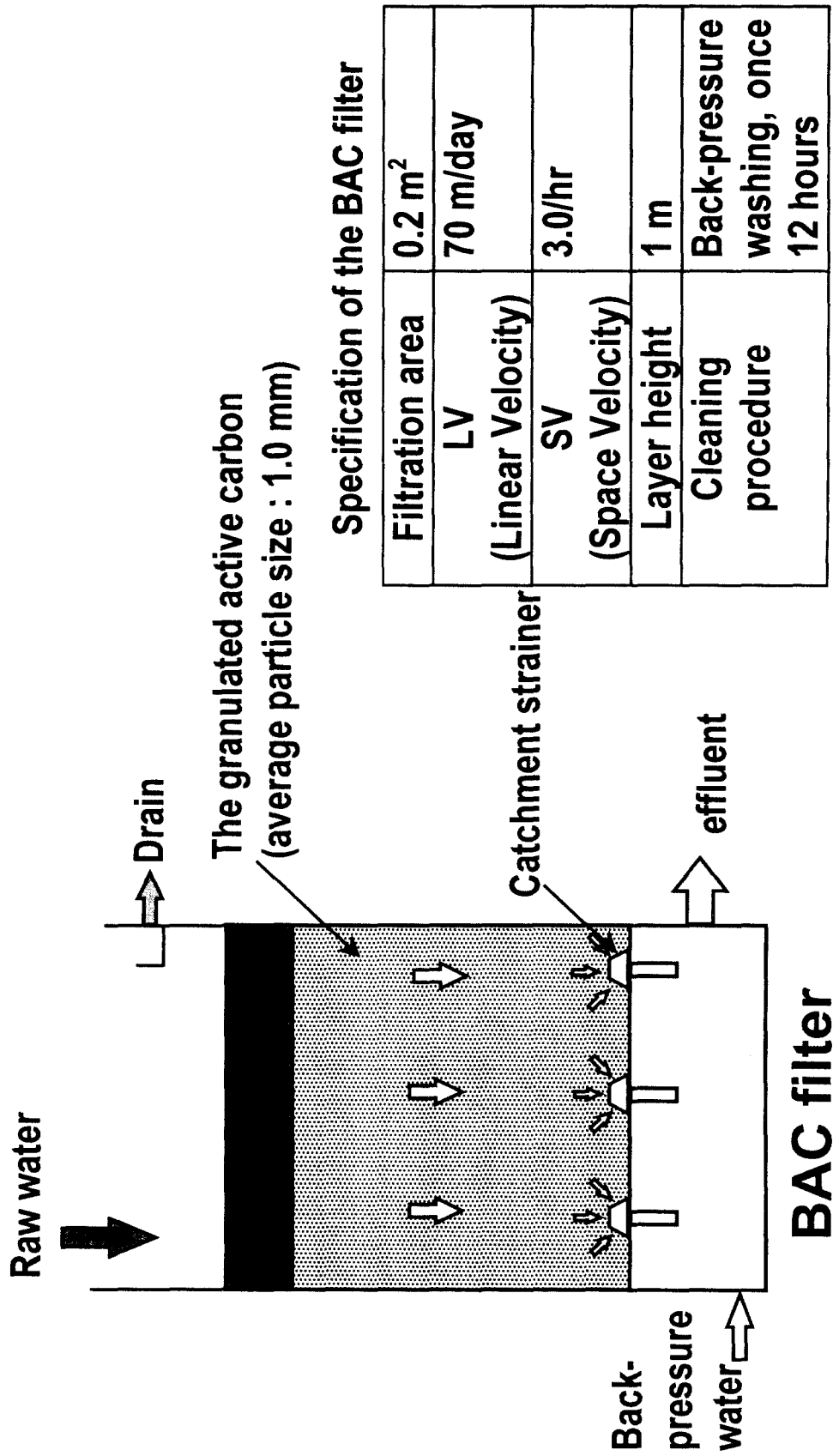
◆ Sodium hypochlorite was added to back-pressure water for washing in order to become 3 mg/L at the available chlorine concentration.

## **Outline**

- ◆ **Introduction**
- ◆ **Experimental Method**
- ◆ **Pretreatment and Membrane filtration with use of the biological activity charcoal**
- ◆ **Membrane filtration of the water with addition of powder active carbon**
- ◆ **Assumption of the membrane fouling material**
- ◆ **Summary**

**BAC**

**The Organic substance was removed by Adsorption and Biodegradation.**





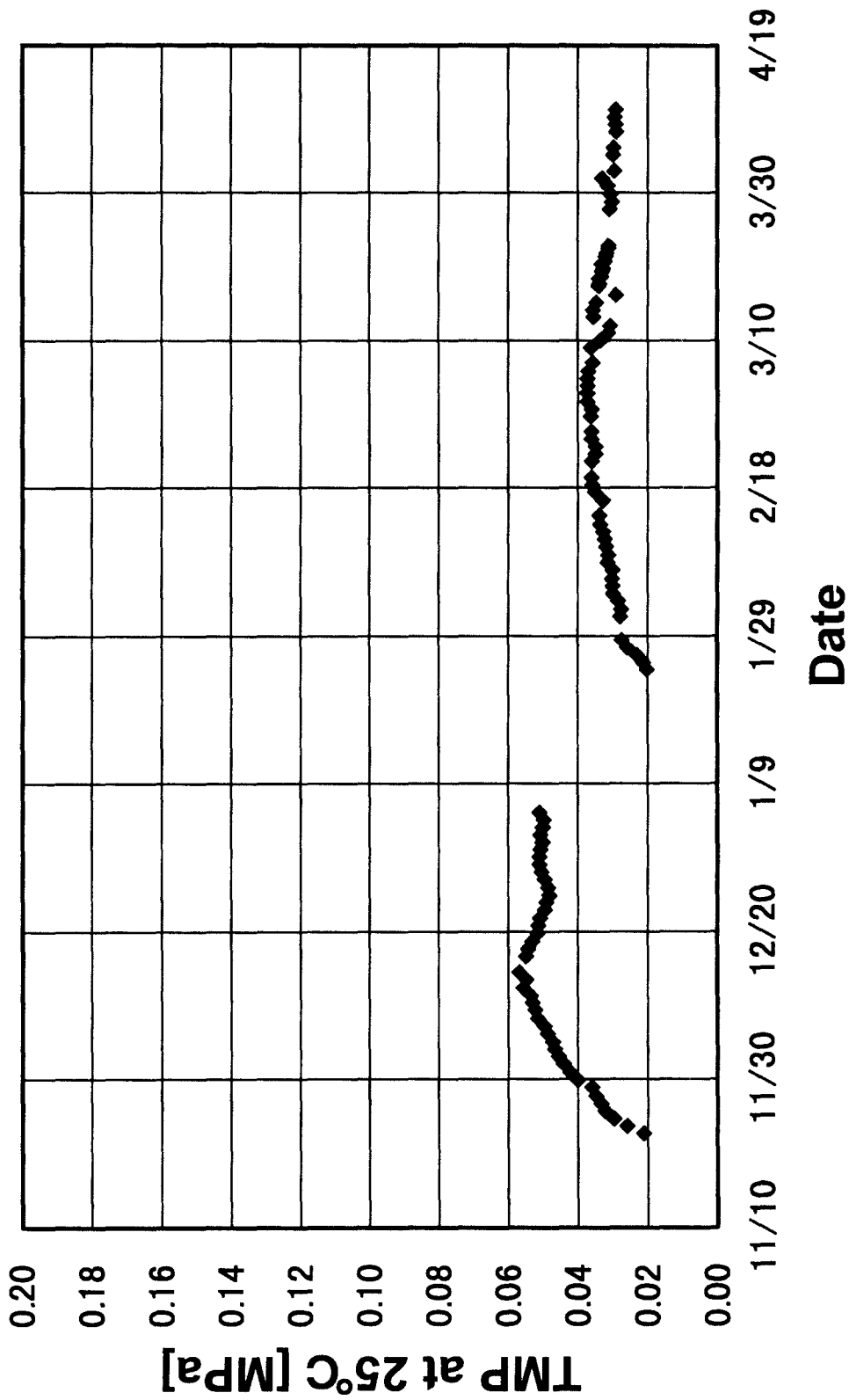
**BAC****The process water quality of the BAC system**

	Raw water	BAC treated water	Membrane filtration water
Ammonia nitrogen (mg/L)	0.21	< 0.04	—
Nitrite nitrogen (mg/L)	0.045	< 0.02	—
Nitrate nitrogen (mg/L)	2.59	2.48	—
Total Organic Carbon	2.2	0.61	0.43
TOC (mg/L)			
Dissolved Organic Carbon	1.4	0.40	0.35
DOC (mg/L)			
Permanganate value (mg/L)	6.1	1.5	0.83
Suspended Solid (mg/L)	16.3	0.9	—
E260 (—)50mm-cuvette	0.119	0.016	0.014
Color (unit)	5.9	1.8	0.0
Turbidity(unit)	6.6	1.0	0.0
Soluble manganese (mg/L)	0.016	< 0.005	—

- ◆ The ammonia nitrogen is being removed by the BAC processing.
- ◆ The high removal ratio was obtained in many organic substance indexes.

BAC

## Time course of Trans-Membrane pressure of the BAC system



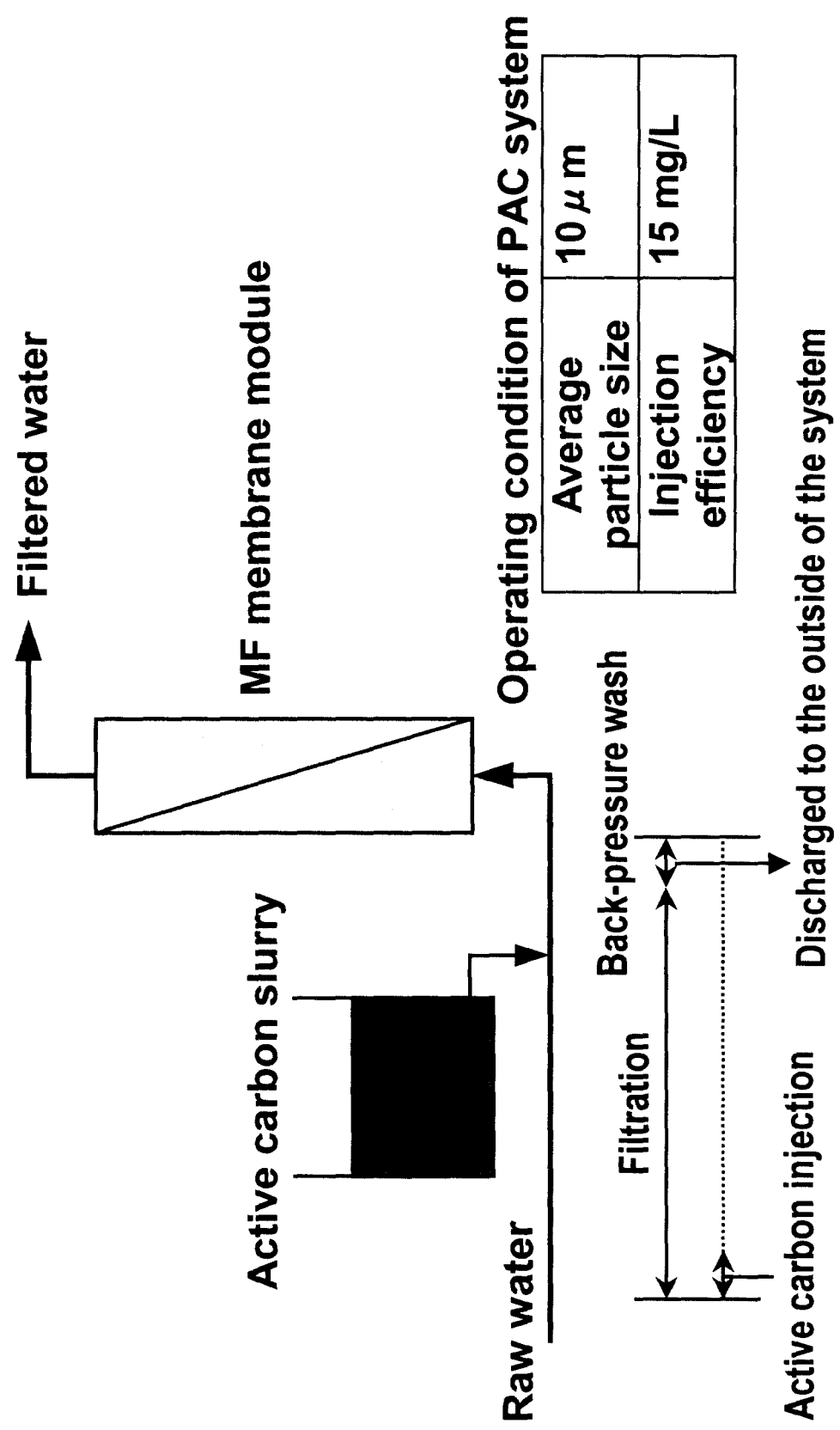
◆ Prolonged operation was carried out at the low TMP of 60 kPa or less.

## **Outline**

- ◆ **Introduction**
- ◆ **Experimental Method**
- ◆ **Pretreatment and Membrane filtration with use of the biological activity charcoal**
- ◆ **Membrane filtration of the water with addition of powder active carbon**
- ◆ **Assumption of the membrane fouling material**
- ◆ **Summary**

**PAC**

**Powder Active Carbon (PAC) was sent to membrane module with the raw water.**



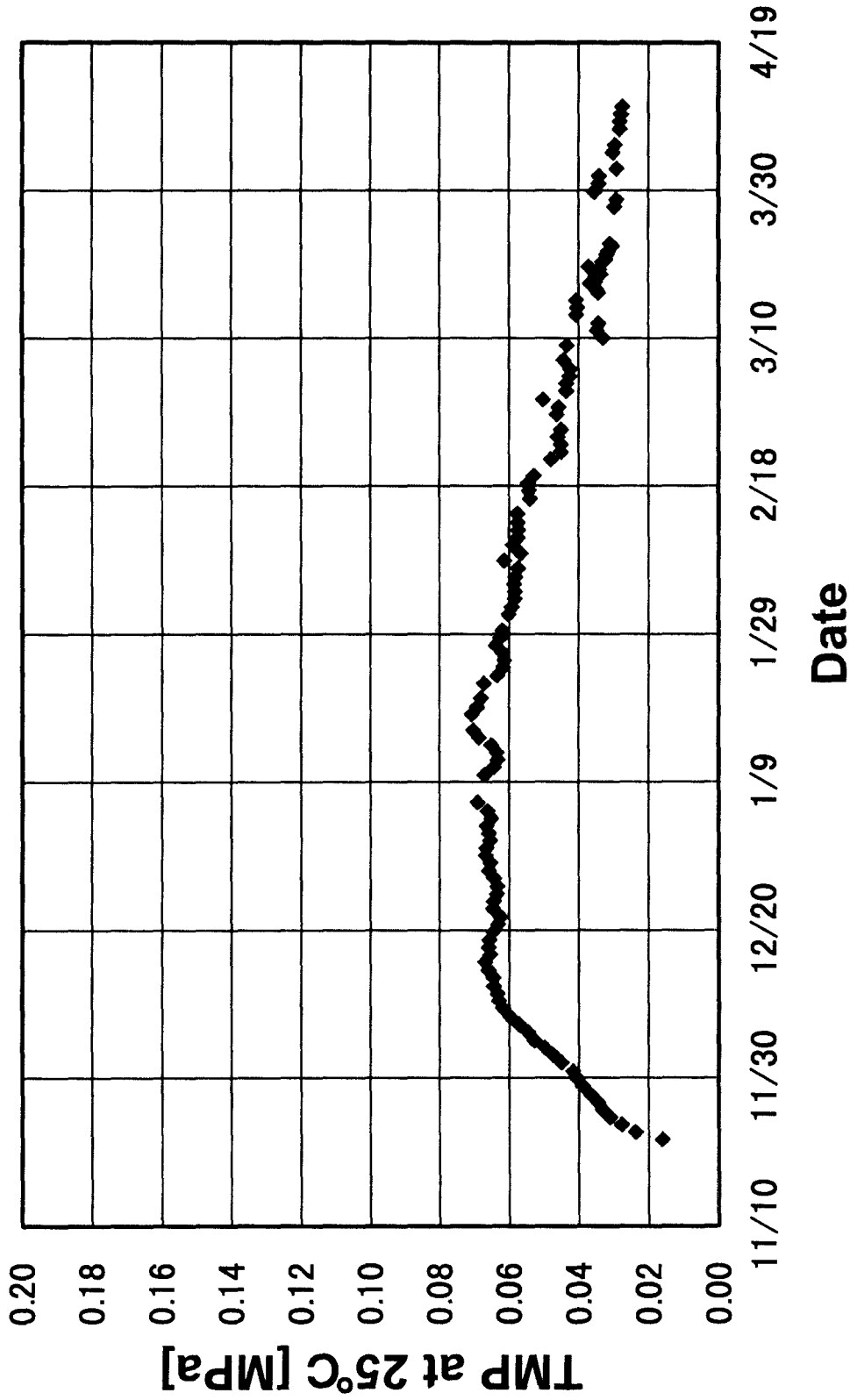
## Membrane filtration water quality of the PAC system

	Raw water	Membrane filtration water
TOC (mg/L)	2.2	0.7
DOC (mg/L)	1.4	0.63
Permanganate value (mg/L)	6.1	1.8
E260 (-)5mm-cuvette	0.119	0.045
Color (nit)	5.9	0.3
Turbidity (nit)	6.6	0.0

◆ The removal ratio of about 60% was obtained at DOC and E260.

PAC

# Time course of TMP of the PAC system



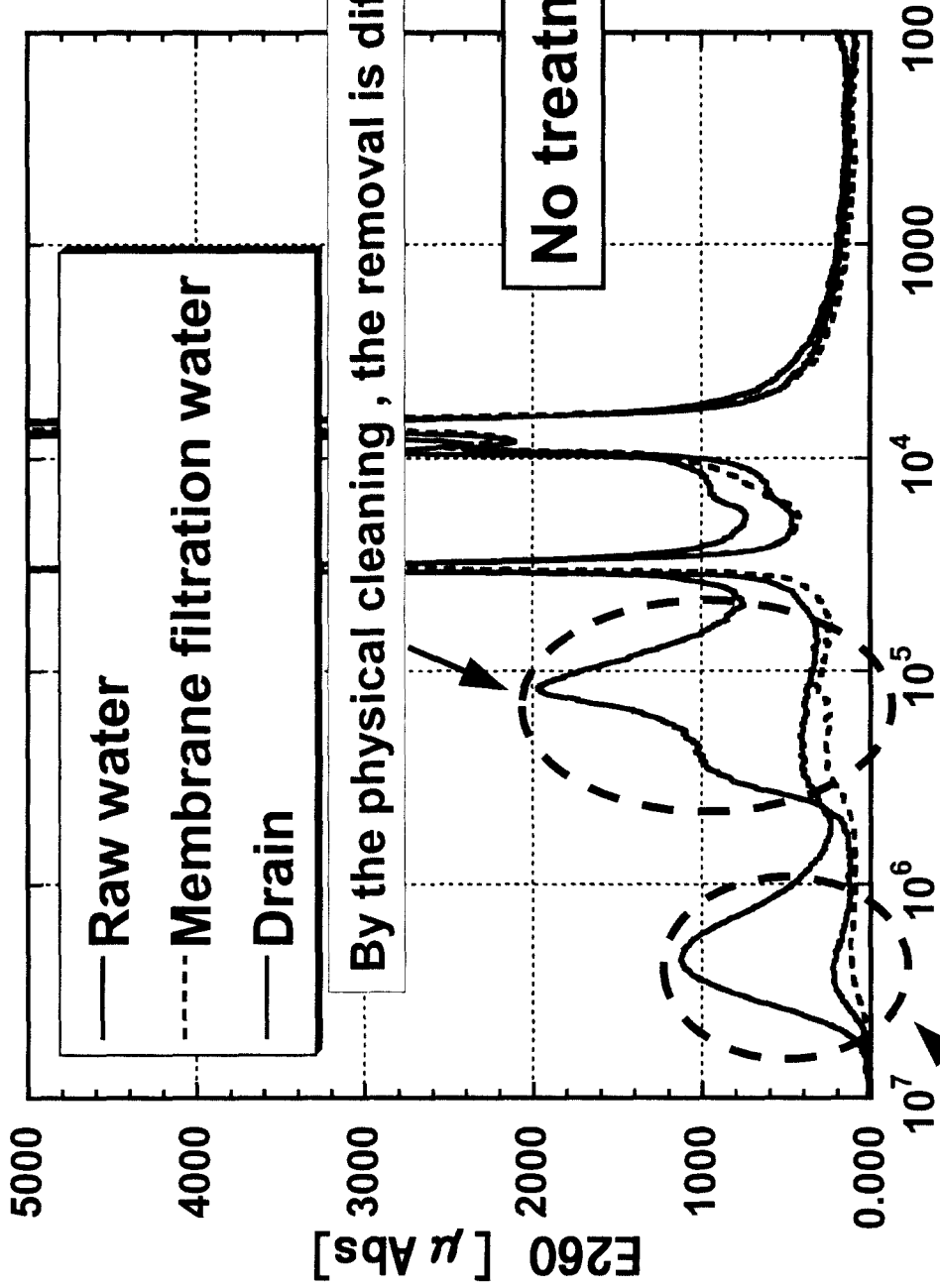
◆ Long-term stabilized operation was carried out.

## **Outline**

- ◆ **Introduction**
- ◆ **Experimental Method**
- ◆ **Pretreatment and Membrane filtration with use of the biological activity charcoal**
- ◆ **Membrane filtration of the water with addition of powder active carbon**
- ◆ **Assumption of the membrane fouling material**
- ◆ **Summary**

Fouling material

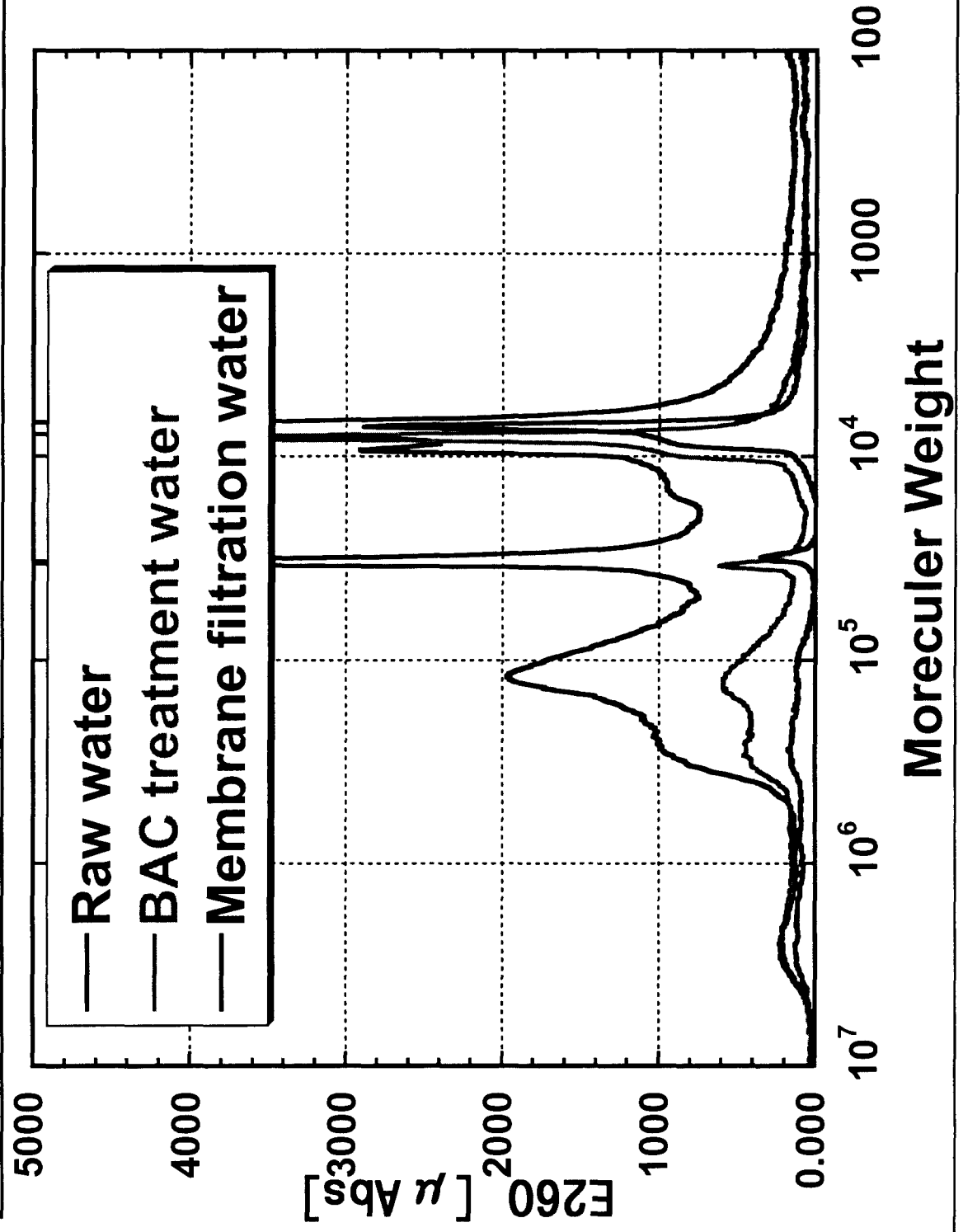
By the physical cleaning, it is difficult to remove the organic substance of 40,000-400,000 molecular weight.





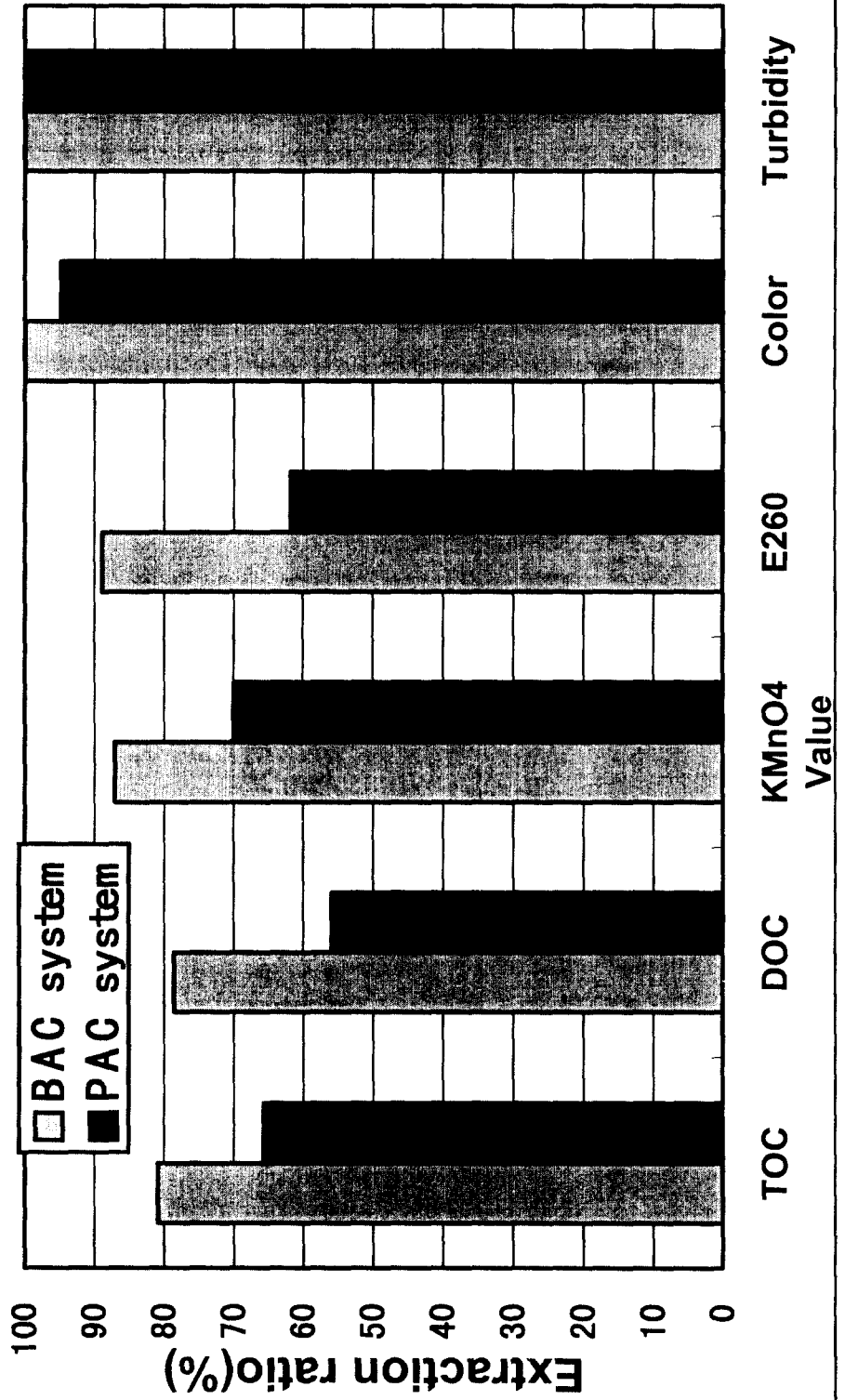
**Fouling material**

**The molecular weight distribution by process.**



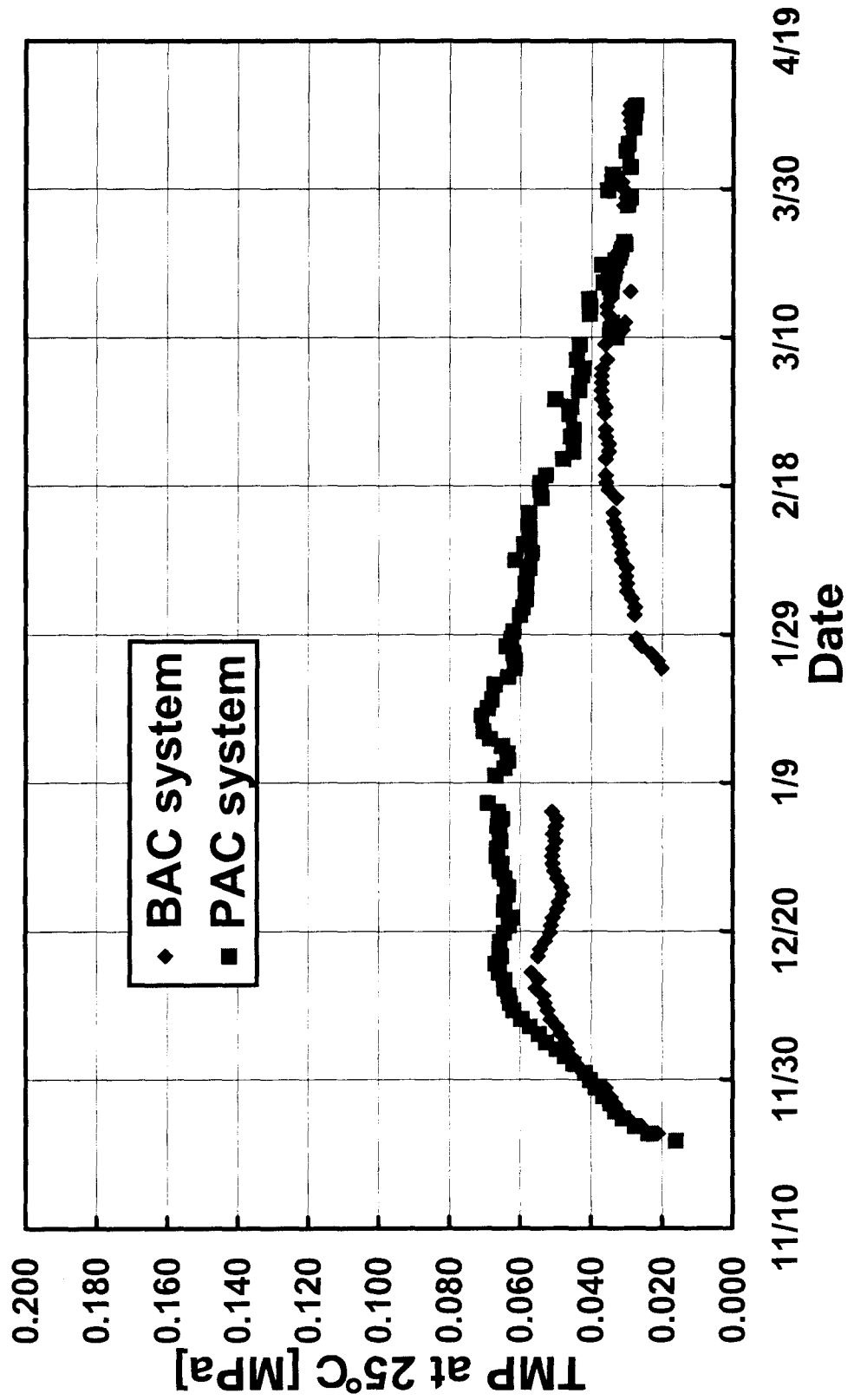
## Summary(1)

- ◆ In the pretreatment by the active carbon , it was removable in respect of the membrane fouling material.
- ◆ The removal ratio of organic substance was obtained.



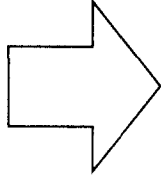
## Summary(2)

◆ Both system can carry out the long-term membrane filtration operation stably.



## **Future Development**

**Membrane fouling depression effect by the BAC filtration will be clarified.**



- ◆ The membrane filtration flux will be increased.
- ◆ The physical cleaning frequency of the membrane filter will be decreased.

**By changing injection efficiency of PAC, membrane filtration water quality will be evaluated.**