

给水深度处理及饮用水安全保障 技术交流会

Actiflo[®] Carb in Drinking Water Deep Treatment

——Ozone+GAC vs Actiflo[®] Carb

Actiflo[®] Carb 在饮用水深度处理中的应用

——基于某自来水处理厂臭氧+活性炭法
与微砂循环高效加炭沉淀法的比较

Content 目录

- I. **Background 背景**
- II. **Deep Treatment Method One: Ozone+GAC Filter**
深度处理方法一:臭氧+活性炭滤池
- III. **Deep Treatment Method Two: Actiflo Carb Settler**
深度处理方法二:微砂循环高效加炭沉淀池
- IV. **Comparison 方法比较**
- V. **Project Reference 工程实例**

I - Background

背景

Environment Background 环境背景

- ▶ NOM (Natural organic matter) affects potable water quality by contributing to disinfection by-products (DBPs), biological re-growth in the distribution system, colour, taste, and odour problems.

在配水网络系统中，**NOM(天然有机物)**会因在消毒过程中形成副产物(**DBPs**)以及生物再生长从而影响饮用水的质量、颜色、气味和恶臭问题。

- ▶ Total organic carbon (TOC) or dissolved organic carbon (DOC) provide an indication of the total organic matter concentration.

总有机物质的含量可以通过总有机碳(**TOC**)或溶解性有机碳(**DOC**)的含量来反映。

Background Of Case Study – DBPs Limited in Drinking Water 案例背景—饮用水中的消毒副产物的限值

Index指数	Limited date限值
Chlorodi bromomethane 氯二溴甲烷	0.1
Bromodi chloromethane 溴二氯甲烷	0.06
Dichloroacetic acid 二氯乙酸	0.05
1,2-dichloroethane 1,2-二氯乙烷	0.03
Dichloromethane 二氯甲烷	0.02
THMS 三卤甲烷	1
TCA 三氯乙酸	0.1
Bromoform 三溴甲烷	0.1

Actiflo[®] Carb : Background 微砂循环加碳高效沉淀池背景

► Risk of Treatment Drinking water market 饮用水处理市场风险

> First goal : Treat the Organic Matter in raw water

首要目标：处理原水中的有机物质

> Only two countries have an official TOC regulation :

只有两个国家具有官方**TOC**监管制度：

→ USA: D/DBP Rule which requires the following % Removal of TOC

消毒/ 消毒副产物条例要求如下的**TOC**去除率

Matrix of required TOC Removal Percentage 规定的TOC去除率矩阵 Raw Water Alkalinity原水碱度 (mg/L as CaCO ₃)			
Raw Water 原水 TOC (mg/L)	0 to 60	> 60 to 120	> 120
2.0 ≤ TOC ≤ 4.0	35.0%	25.0%	15.0%
4.0 ≤ TOC ≤ 8.0	45.0%	35.0%	25.0%
TOC ≥ 8.0	50.0%	40.0%	30.0%

→ France : TOC in DW is limited to 2 mg/l based on a 2001 French law

根据**2001**年法国一项法律饮用水中**TOC**浓度限值 $\leq 2\text{mg/l}$

> Canada usually follows US EPA regulations

加拿大通常遵循美国环境保护局规章制度

✓ WHO **suggests** to reach 2 mg/l of TOC in treated water
世界卫生组织**建议**经过处理的水中**TOC**达到**2mg/l**的标准

Actiflo[®] Carb : Background 背景

► Risk of Treatment Drinking water market 饮用水处理市场风险

> NOM problems in surface water, even with TOC regulation :

即使有TOC指标的约束，在地表水中也存在NOM的问题：

- **Problem : Organic matter reacts with chlorine to produce carcinogenic by-products**

问题：有机物质与氯反应产生致癌性副产物

- **THM limits to be respected : 各国THM限值如下：**

- *Italy 意大利 : THM = 30 µg/l (world record)*
- *Germany 德国 : THM = 50 µg/l*
- *USA 美国: THM = 80 µg/l (also for HAAs)*
- *France 法国 : THM = 100 µg/l*
- *Australia 澳大利亚 : THM = 250 µg/l*

HAAs limits will also be applied in Europe soon, as it is already the case in the USA.

正如美国已经限制卤乙酸的浓度，欧洲也会尽快对此限制。

- **DOC removal to avoid / minimize biological development in the DW network (sanitary purpose)** 在饮用水配水网络中需要去除DOC以避免/减少生物生长(卫生目标)

Actiflo[®] Carb : Developing Background 发展背景

> Pesticides and emerging micropollutants in raw water :

原水中农药和新兴微污染物:

- Hundreds of different pesticide compounds found in surface water
原水中发现上百种不同的农药化合物
- « The Top 8 »
 - AMPA 氨甲基磷酸(, (France 法国)
 - Glyphosate 草甘膦, (France 法国)
 - Diuron 敌草隆, (France 法国)
 - Isoproturon 异丙隆, (France 法国)
 - Atrazine 阿特拉津, Simazine 西玛津, (All Europe 全欧洲)
 - Desethylatrazine 二丁基阿特拉津, (France, Germany, Czech Republic 法国、德国和捷克)
 - Hexazinon 环嗪酮 (Czech Republic 捷克)
- **New micropollutants are continuously discovered!**
新微污染物还在不断地被发现!

Some Matured Technology of Deep Treatment in Market

市场上成熟的几种深度处理技术

- Ozone+GAC/ 臭氧+活性炭滤池
- Actiflo Carb/ 高效加炭沉淀池
- MIEX of ORICA Watercare (Australia)
澳大利亚澳凯瑞的树脂水处理系统(麦克斯)
- Nanofiltration membranes/ 纳米过滤膜
- UF /超滤
-

Design Basis for a Case of Technology of Deep Treatment 深度处理技术案例基础信息

- ▶ This case study is based on Beijing Dingjiawa DWTP.
这个案例基于北京某饮用水
处理厂。
- ▶ The treatment capacity
处理量:340,000m³/d.
- ▶ The raw water quality
原水质量



Parameter 参数	Design Value 设计值	Unit 单位
Turbidity 浊度	300	NTU
Hardness 硬度	247	mg/L
Alkalinity 碱度	179	mg/L
CODmn	8	mg/L
pH	8.47	-

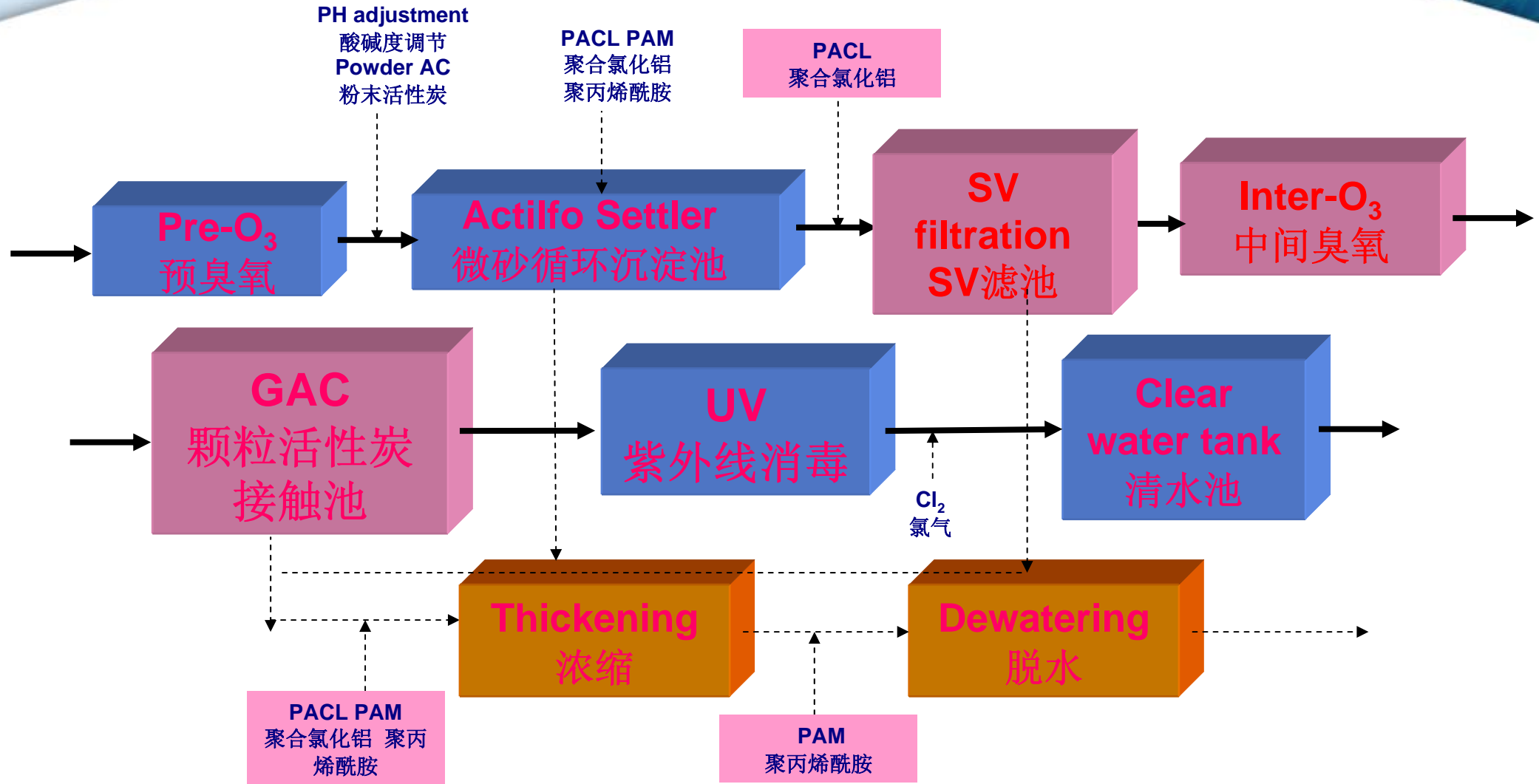
As no TOC parameter was given, we have to use CODmn for comparison.
因为没有提供总有机碳的参数，我们只能通过COD_{Mn}来比较。

II - Deep Treatment Method One: Ozone+GAC

深度处理方法一：臭氧+活性炭滤池

Deep Treatment Method One: Ozone+GAC Filter

深度处理方法一：臭氧+活性炭滤池



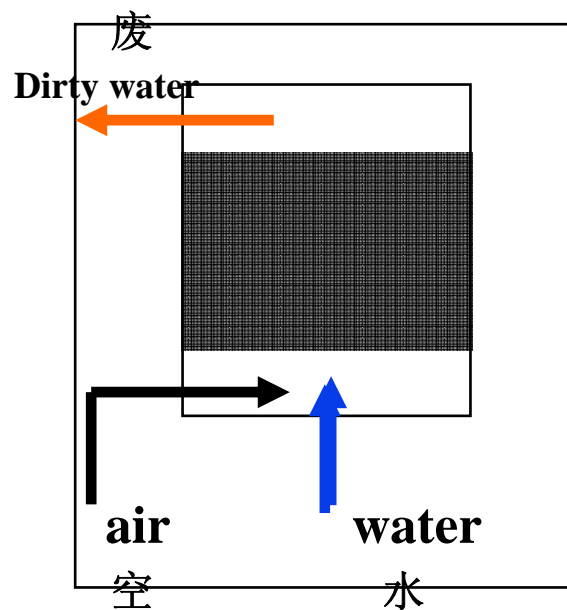
Process Description

工艺描述

	Pre-ozonation 预臭氧	Inter-ozonation 中间臭氧
Flow rate 流量	14875 m ³ /h	14875 m ³ /h
Number of process lines 流程线数目	2	2
Description of contact chamber 接触室描述	One contacting tank 一个接触池	Three contacting tank 三个接触池
O ₃ dosing 臭氧投加量	Average dosing rate (mg/l): 0.5 Max dosing rate(mg/l):1 平均投加率: 0.5 mg/l 最大投加率: 1 mg/l	Average dosing rate (mg/l): 1.5 Max dosing rate(mg/l):2.2 平均投加率: 1.5 mg/l 最大投加率: 2.2 mg/l
Contacting time 接触时间	2 min 分钟	6min 分钟

GAC Filtration – Process Description

活性炭过滤—工艺描述



反冲洗过

Item 项目	Deep treatment line深度处理线 (340,000m ³ /d)
Flow rate流速	14 875 m ³ /h
Filter number滤池数	10
Filter surface滤池面积	111.98m ² /filter
Retention持续时间	11min
Filtration media 过滤介质	GAC depth 滤层深度:2.4m Effective size有效粒径: 1.0mm Water height above filter bed during filtration 过滤期间滤床上水深: 1.3m
Filtration rate过滤速度	N: 13.5m/h

III - Deep Treatment Method Two: Actifo Carb Settler

深度处理方法二：微砂循环加碳高效沉淀池

Deep Treatment Method Two: Actiflo Carbon

深度处理方法二：微砂循环高效加炭沉淀池

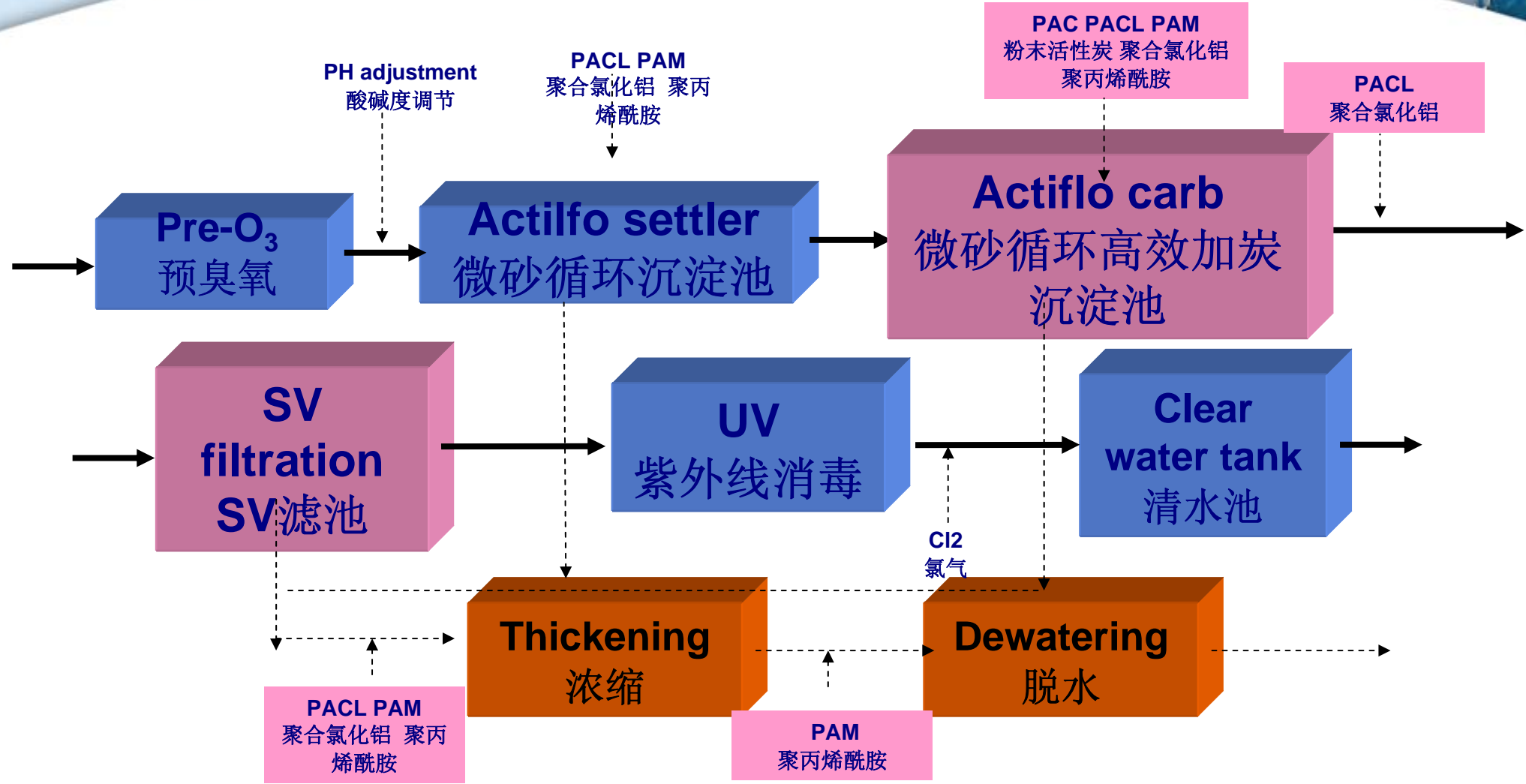
PAC is used in drinking water processes to remove:

粉末活性炭用于饮用水工艺中去除：

- **Pesticides** 农药
- **Algae microtoxins** 藻类微毒素
- **Other micropollutants** 其他微污染物
(such as endocrine disrupting compounds and pharmaceuticals
(比如环境内分泌物干扰物和药物残余))
- **Natural Organic Matters (NOM)**
天然有机物

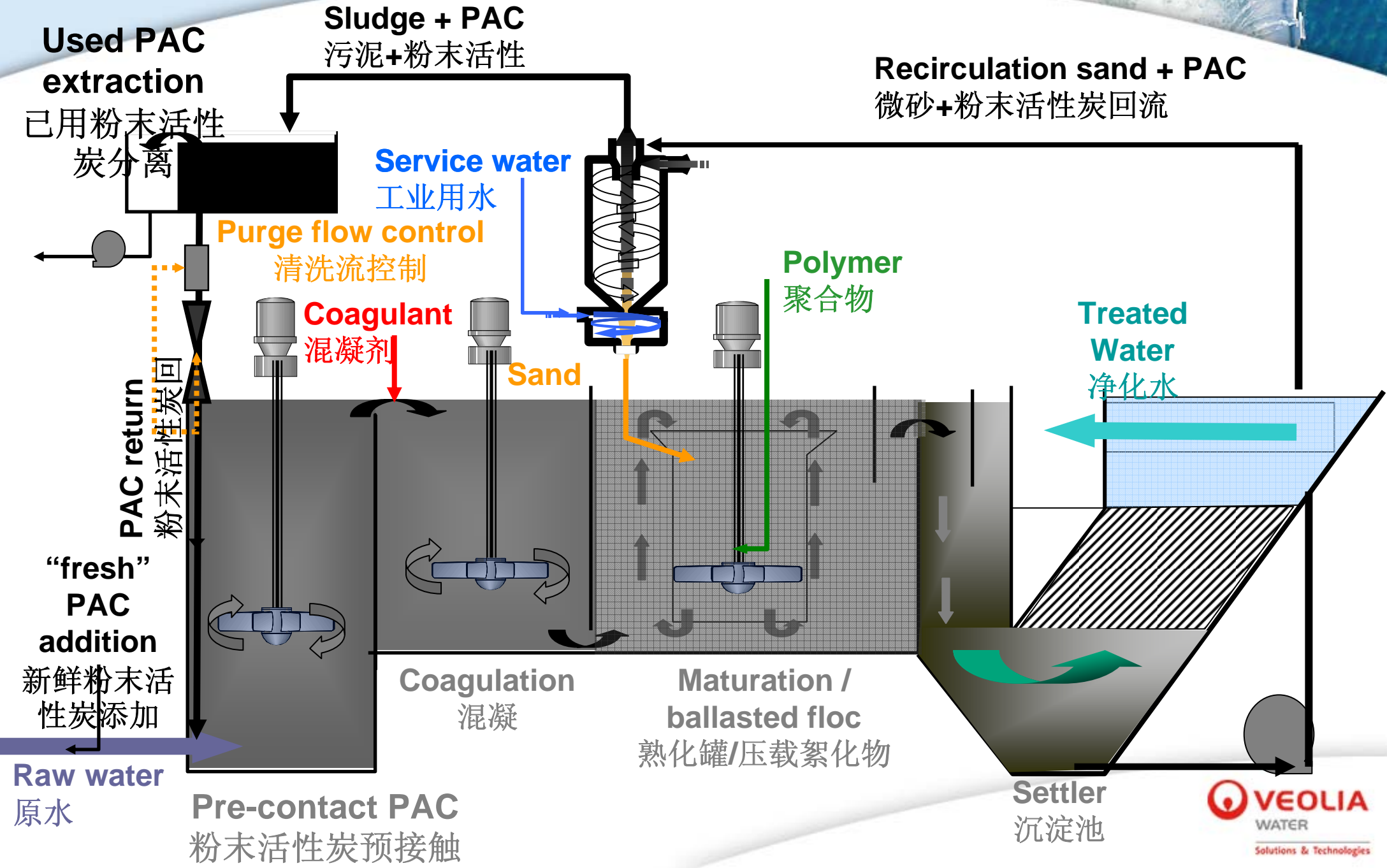
Deep Treatment Method Two: Actiflo Carbon

深度处理方法二：微砂循环高效加炭沉淀池



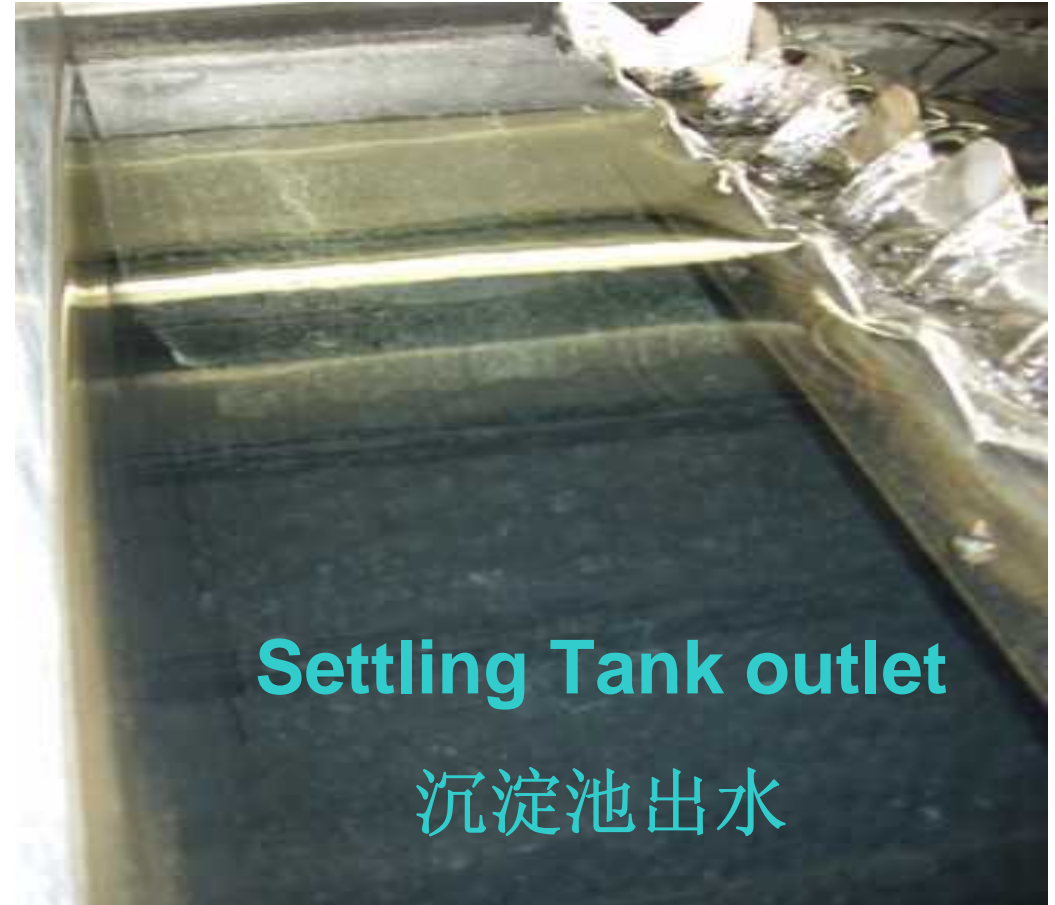
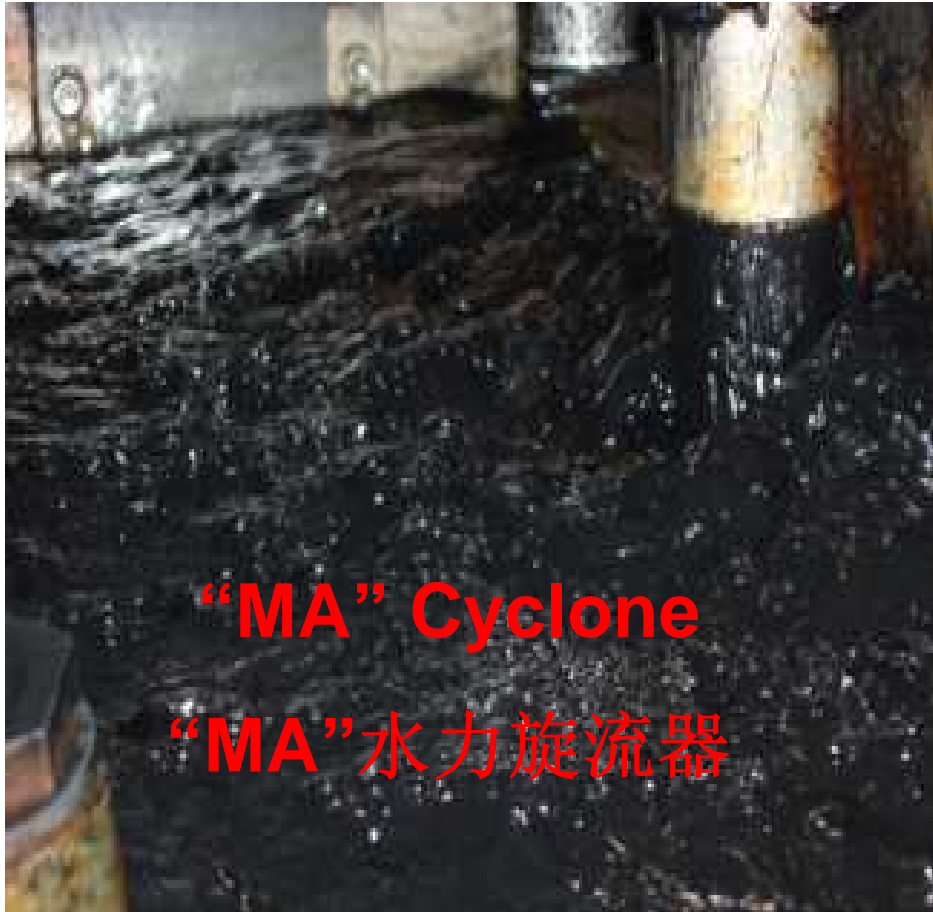
Actiflo Carb – Operating Principle

微砂循环高效加炭沉淀池—运行原理



Actiflo Carb – Operating Principle

微砂循环高密度加炭沉淀池—运行标准



Operation 运行

- ▶ Compared to a regular Actiflo, a contact PAC tank is added upstream of the coagulation tank.

与常规的微砂循环沉淀池相比，增加了一个粉末活性炭接触池在了混凝池的上游。

- ▶ When the quality of the water to be treated requires PAC injection, fresh PAC is added continuously to the raw water to be treated. PAC is recirculated from the settler to the contact tank through a **MA hydrocyclone**.

当需要粉末活性炭投加的时候，新鲜的粉末活性炭连续投加在接触池前原水中。粉末活性炭从沉淀池通过**MA水力旋流器**而部分循环使用。

- ▶ In the hydrocyclone, PAC goes in the overflow with the sludge, while sand is washed and returned through underflow to the maturation tank.

在水力旋流器里，粉末活性炭与污泥一同被分离并溢流，微砂被分离并跌落入车电池中并循环使用。

Note: PAC costs represent around 80% of the running costs of Actiflo Carb.

注释：粉末活性炭成本相当于大约80%的高效池的总运行成本。

Actiflo Twin Carb (Actiflo + Actiflo carbon)

双子高效池（微砂循环高效池+微砂循环加碳高效池）

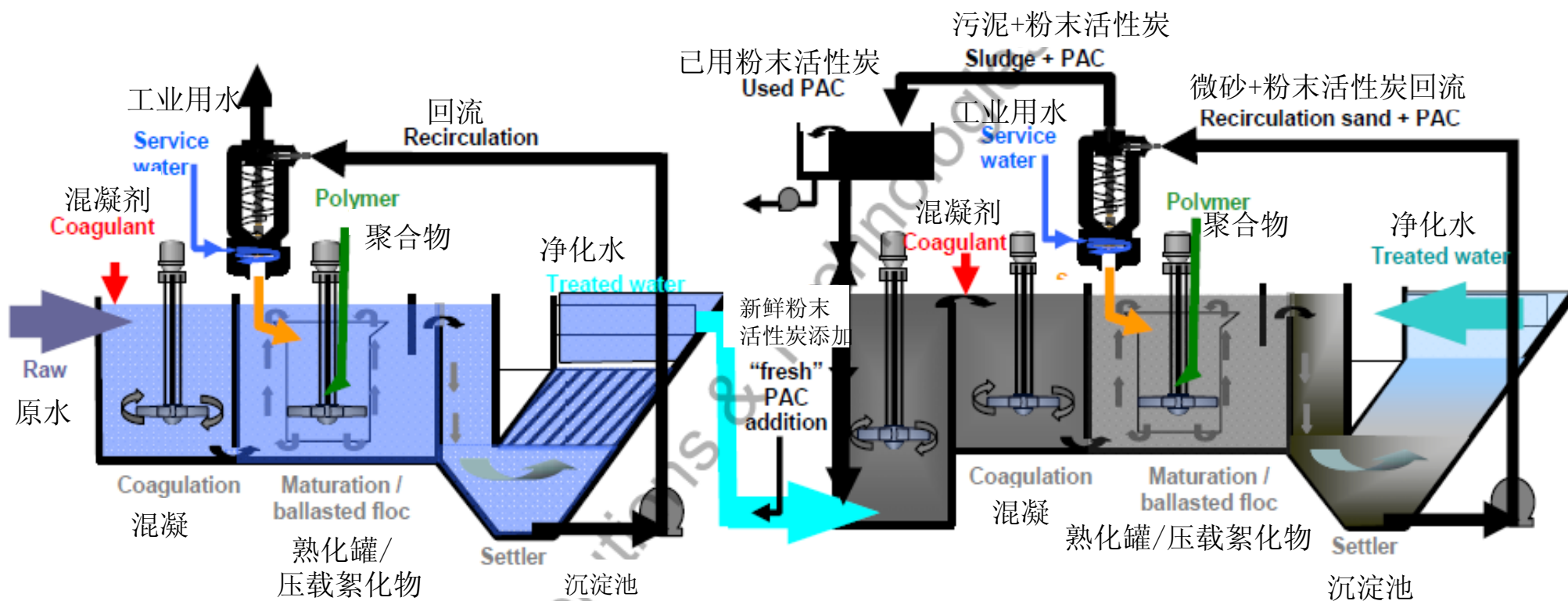


Figure 2 : Diagram of Actiflo[®] Twin Carb

Actiflo Twin Carb 双子高效沉淀池流程图

Actiflo Twin Carb 双子高效加碳微砂高效池

- ▶ It is a combination of a regular Actiflo followed by an Actiflo carbon. It is used **instead of an Actiflo carbon when the water inlet turbidity is >5NTU or SS>5mg/l.**

它是一个常规微砂循环沉淀池接在微砂循环高密度加炭沉淀池后面的组合。代替通常的微砂循环高效加炭沉淀池当入水浊度 **>5NTU**或固体悬浮物**>5mg/l**。

- ▶ In the 1st Actiflo, turbidity and SS are removed, while NOM and micro-pollutants are removed in 2nd stage.

在第一个微砂循环沉淀池里，主要是浊度和固体悬浮物被去除。而在第二高效池阶段，主要去处天然有机物和微污染物。

Actiflo Carbon Process Description

微砂循环高效加炭沉淀池工艺描述

PAC contact tank粉末活性炭接触池 (3 units 3个系列)	
Number of units单元数目	
Design 设计	One contact tank for one ACTIFLO settlers每个微砂循环沉淀池设一个接触池 PAC Retention Time =5min 粉末活性炭停留时间=5分钟
PAC 粉末活性炭	Dosage:15 mg/L average ;25 mg/L as maximum 投加量: 15mg/L平均; 25mg/L最大 For 45 – 50% efficiency removal 对于45-50%去除率 PAC concentration inside the actiflo is around 2 g/L. 微砂循环沉淀池内粉末活性炭浓度大约2g/L
Coagulation tank混凝池 (3 units 3个系列)	
Design 设计	One coagulation tank for one ACTIFLO settlers每个微砂循环沉淀池设一个混凝池 Coagulation Retention Time = 2.21 min 混凝剂停留时间=2.21分钟
Coagulant 混凝剂	Coagulant : PACL (10% Al₂O₃, density=1.20) 混凝剂: 聚合氯化铝 (10%三氧化二铝, 密度=1.20) Dosage : 20 mg/L 投加量: 20mg/L
Maturation tank熟化罐 (3 units 3个系列)	
Design设计	One maturation tank for one ACTIFLO settlers一个熟化罐每微砂循环沉淀池 Retention Time = 6.41min 停留时间=6.41分钟
PAM dosing 聚丙烯酰胺投加量	0.8mg/L Dosing type:2g/L(solution) 投加类型: 2g/L (溶液)
Settling tank沉淀池 (3 units 3个系列)	
Design 设计	Settler Diameter沉淀池直径= 14 m Upflow Velocity上升流速: 35 m/h Hydraulic retention time水力停留时间= 15.92min The sludge concentration of the PAC extracted提取的粉末活性炭的污泥浓度: 1-2 g/L

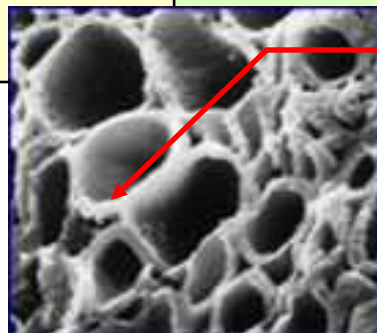
Actiflo Carb – Various types of PAC tested

微砂循环高效加炭沉淀池—被测试的粉末活性炭的多种类型

Selection of the right PAC is thus paramount

适当粉末活性炭的选择标准如下

	Pica XP 17	Pica MP 23	Norit W 35
Origin来源	Coconut Shell 椰子壳	Wood 木头	Wood 木头
Activation活性	Thermal热力	Thermal热力	Thermal热力
Apparent density 透明度	0.52	0.41	0.43
Porosity密度	Microporous微孔	Meso/microporous 介孔/微孔	Microporous微孔
Iodine Index 碘指数 mg/g	920	980	850
Average size μm 平均粒径	24	23	15



Micropores微孔 < 1 nm
1 < Mesopores介孔 < 25 nm

PAC Injection 粉末活性炭投加

- ▶ It is important to have a separate dosing pump and injection line for each Actiflo Carb.

每一个微砂循环高效加炭沉淀池设有不同投加药线路是很重要的

- ▶ PAC dosing is controlled by: 控制粉末活性炭投加量的因素:

- Organic Matters measured by UV absorbance.

紫外吸光度测量有机物浓度

- Water flow at the inlet of the Actiflo Carb.

微砂循环高效加炭沉淀池处理水量

PAC Recirculation 活性炭回流

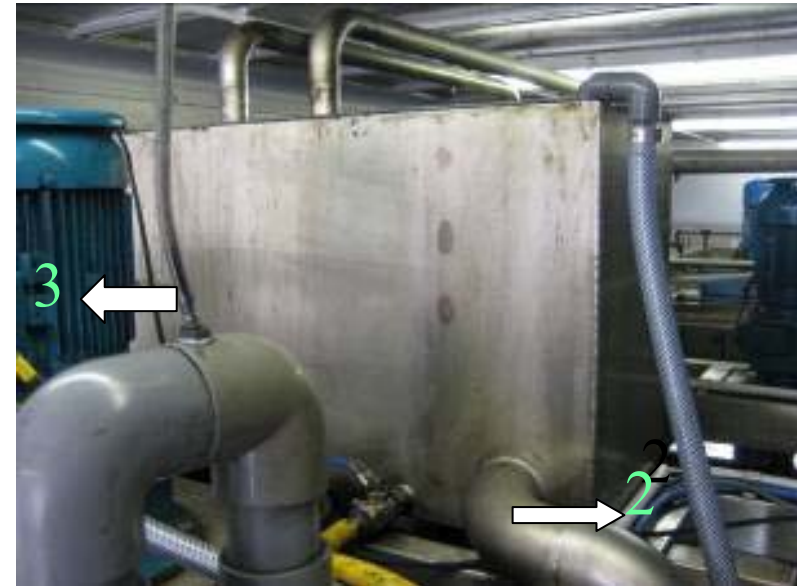
- ▶ The pump recirculating the PAC, sand and sludge mixture from the settler is a special **centrifuge pump with rubber coating**.
- ▶ 回流从沉淀池沉淀下来的粉末活性炭、砂和污泥混合物的泵是一个特殊的橡胶内衬和叶轮包层的离心泵。



PAC Extraction 粉末活性炭分离

- ▶ When fresh PAC is injected, “old” PAC should be extracted to keep a constant PAC average concentration.

当投加新鲜的粉末活性炭时，使用过的粉末活性炭应该被分离出以保持一个恒定的平均粉末活性炭浓度。



1: PAC+Sludge from the hydrocyclone overflow
来自水力旋流器溢流的粉末活性炭+污泥

2: PAC+Sludge to the contact tank
进入接触池的粉末活性炭+污泥

3: PAC extraction 粉末活性炭分离

SV filtration 快速滤池

	Ozone+GAC 臭氧+活性炭	Actiflo carbon 微砂循环高效加炭沉淀池
Filter number 滤池数目	16	20
Filter surface 滤池表面积	112.9m²/filter	112.9m²/filter
Filtration media 过滤介质	sand depth 砂滤层厚度 1.1m	sand depth 砂滤层厚度 1.1m
Filtration rate 过滤速率	N: 8m/h	N: 6.3m/h

Sludge treatment 污泥处理

Construction 结构	Ozone+GAC 臭氧+活性炭滤池			Actiflo carbon 微砂循环高效加炭沉淀池		
	Sludge Concentration 污泥浓度	Sludge Production 污泥产量	Sludge flow rate 污泥流速	Sludge Concentration 污泥浓度	Sludge Production 污泥产量	Sludge flow rate 污泥流速
ACTIFLO settler 微砂循环沉淀池	1.2 g/l	10,280 kg/d	357 m ³ /h	1.2 g/l	10,280 kg/d	357 m ³ /h
SV Filtration SV快速滤池	54 mg/l	390kg/d	450m ³ / back wash	23mg/l	207kg/d	450 m ³ / back wash
ACTIFLO carbon 微砂循环高效加 炭沉淀池	0	0	0	1g/l	4708kg/d	370 m ³ /h
GAC Filtration 活性炭滤池	25mg/l	202kg/d	810m ³ / back wash	0	0	0
Total sludge production 总污泥产量	10,872kg/d			15,195kg/d		

IV - Comparison

比较

The footprint 占地面积		Ozone+GAC 臭氧+活性炭滤池	Actiflo carbon 微砂循环高效加炭沉淀池	Area1 (m2) 占地1	Area2 (m2) 占地2
water line 水处理线	Post coagulation tank 后混凝池	L*W*H =45*8.9*8 长*宽*高	NA	401	NA
	Actiflo carbon(include post coagulation)	NA	L*W*H =48.4*43.2*9	NA	2091
	微砂循环高密度加炭沉淀池(包括后混凝) SV filter滤池	L*W*H =73.5*54.7*7.3	L*W*H =97*54.7*7.3	4020	5306
	Backwash pump staion反冲洗泵站	L*W*H=22*12*8.3	L*W*H=22*12*8.3	264	264
	Inter-pump station中间提升泵站	L*W*H=17.15*12.6*5.6	NA	216	NA
	Inter-O ₃ 中间臭氧	L*W*H=17.15*43.5*7.3	NA	746	NA
	GAC filter颗粒活性炭滤池	L*W*H=67.3*47*7.8	NA	3163	NA
	Backwash pump staion 回流泵站	L*W*H=19*12*8.5	NA	228	NA
	Ozone generation room臭氧制备	L*W*H=14.4*15*5.8	NA	216	NA
	Ozone container臭氧储存	L*W*H=10*10*4.3	NA	100	NA
	PAC preparation粉末活性炭制备单元	L*W*H=13*11*11	NA	NA	143
	总计			9354	7804

Average OPEX per day 平均运营成本/每天

	Ozone+GAC 臭氧+活性炭滤池				Actiflo carbon 微砂循环高效加炭沉淀池		
	unit /day	cost /unit (RMB)	RMB 人民币		unit /day	cost /unit (RMB)	RMB 人民币
Waterline(水处理线)				Waterline(水处理线)			
powder activated carbon(PAC)粉末活性炭	NA			powder activated carbon(PAC)粉末活性炭	3,570	5.00	17,850
coagulant(PACL, 10%)混凝剂(聚合氯化铝)	1,785	2.00	3,570	coagulant(PACL, 10%)混凝剂(聚合氯化铝)	3,750	2.00	7,500
flocculant(PAM ⁻)絮凝剂(聚丙烯酰胺)	NA			flocculant(PAM ⁻)絮凝剂(聚丙烯酰胺)	286	20.00	5,720
Microsand微砂	NA			Microsand微砂	510	1.60	816
O ₂ 氧气	5,355	0.65	3,481	O ₂ 氧气	NA		
Granule activated carbon (lifecyle=5 years)颗粒活性炭(生命周期=5年)	589	4.50	2,651	Granule activated carbon (lifecyle=5 years)颗粒活性炭(生命周期=5年)	NA		
Power, KWh能源	23,242	0.60	13,945	Power, KWh能源	6,556	0.60	3,934
Sludgeline污泥线				Sludge line污泥线			
coagulant(PACL, 10%)混凝剂(聚合氯化铝)	2,640	2.00	5,280	coagulant(PACL, 10%)混凝剂(聚合氯化铝)	2,909	2.00	5,818
flocculant(PAM ⁻)絮凝剂	24	20.00	480	flocculant(PAM ⁻)絮凝剂	26	20.00	520
flocculant(PAM ⁺)絮凝剂	33	40.00	1,305	flocculant(PAM ⁺)絮凝剂	46	40.00	1,840
Power, KWh能源	3,088	0.60	1,853	Power, KWh能源	3,088	0.60	1,853
Sub-total (RMB/day)小计			32,564	Sub-total (RMB/day)小计			45,851

- CAPEX
Actilfo carbon < Ozone + GAC
- 投资
- 微砂循环高效加炭沉淀池 < 臭氧 + 活性炭滤池

O3+GAC (solution 1)
臭氧+颗粒活性炭(解决方案1)

Actiflo Carb (solution 2)
微砂循环高效加炭沉淀池(解决方案2)

CAPEX (M&E) – Exclude Imported VAT 基建费用(机械/设备) —进口增值税除外

Mechanical/Equipment机械/设备	RMB equiv	Mechanical/Equipment机械/设备	RMB equiv
water line水处理线		water line水处理线	
Inter Coagulation tank内混凝池	235,898		
SV filter(16x112.9m ²)SV滤池	16,674,534	Actiflo carb 沉淀池	15,734,848
Inter pumping station内泵站	6,948,328	SV filter(16x112.9m ²)SV滤池	12,681,852
Inter-O ₃ 臭氧间氧化	28,821,186		0
GAC Filter (10x111.98m ²) 颗粒活性炭滤池	23,116,082		0
Chemical dosing system 化学投加系统	356,068	Chemical dosing system 化学投加系统	1,535,456
sludge line污泥线	0	sludge line污泥线	0
Sludge retention tank污泥停留池	993,854	Sludge retention tank污泥停留池	1,116,232
Sludge thickener污泥浓缩池	2,111,208	Sludge thickener污泥浓缩池	2,111,208
Thickened sludge storage tank 浓缩污泥储存池	87,522	Thickened sludge storage tank 浓缩污泥储存池	87,522
Sludge dewatering污泥脱水间	8,454,896	Sludge dewatering污泥脱水间	10,003,696
Chemical system化学投加系统	636,410	Chemical system化学投加系统	687,698
Piping管道系统	0	Piping管道系统	0
water line水处理线	4,871,436	water line水处理线	2,458,718
sludge line污泥线	318,718	sludge line污泥线	318,718
sub-total (exclude spares)小计	93,626,142	sub-total (exclude spares)小计	46,735,948

CAPEX 投资费用

O3+GAC (solution 1) 臭氧+活性炭(解决方案1)		Actiflo Carb (solution 2) 微砂循环高效加炭沉淀池(解决方案2)	
EICA		EICA	
Electrical 电气	6,274,188	Electrical 电气	4,163,760
Automation 自动化	1,538,462	Automation 自动化	1,487,180
Instrumentation 仪表	1,677,780	Instrumentation 仪表	1,582,310
Engineering 工程	400,000	Engineering 工程	400,000
Spare parts 备件部分	-	Spare parts 备件部分	-
sub-total (exclude spares) 小计(备件除外)	9,890,430	sub-total (exclude spares) 小计(备件除外)	7,633,250
M&E Sub-total (with exemption of Custom Duties) 机械&设备 小计(免征关税)	93,626,142	M&E Sub-total (with exemption of Custom Duties) 机械&设备 小计(免征关税)	46,735,948
Custom duties 关税	3,338,743	Custom duties 关税	1,230,368
M&E Sub-total (include CD) 机械&设备 小计(包括关税)	116,745,745	M&E Sub-total (include CD)机 械&设备 小计(包括关税)	63,232,816

O3+GAC (solution 1) 臭氧+颗粒活性炭(解决方案1)		Actiflo Carb (solution 2) 微砂循环高密度加炭沉淀池(解决方案2)	
Installation 安装			
E&ICA installation, including cabling 电气, 仪表, 自动化, 工程安装, 包括电缆	3,200,000	E&ICA installation, including cabling 电气, 仪表, 自动化, 工程安装, 包括电缆	2,700,000
Equipment/mechanical installation (15%) 设备/机械安装	7,021,961	Equipment/mechanical installation (15%) 设备/机械安装	3,505,196
Installation subtotal 安装小计	10,221,961	Installation subtotal 安装小计	6,205,196
Civil Works 土建工程		Civil Works 土建工程	
water line 水处理线		water line 水处理线	
SV Filter 滤池	16,500,000	Actiflo Carb 沉淀池	8,000,000
O ₃ Contact tank 臭氧接触池	2,200,000	SV Filter 滤池	13,000,000
GAC Filter 颗粒活性炭滤池	16,000,000		
sludge line 污泥线		sludge line 污泥线	
Sludge retentation 污泥停留间	1,100,000	Sludge retentation 污泥停留间	1,100,000
Actidyn 高效浓缩池	1,200,000	Actidyn高效浓缩池	1,200,000
Dewatering house 脱水间	1,500,000	Dewatering house 脱水间	1,500,000
Ozone generator room 臭氧制备	500,000	Ozone generator room 臭氧制备	500,000
Chemical room 化学投加车间	750,000	Chemical room 化学投加车间	1,000,000
Civil works subtotal 土建工程小计	39,750,000	Civil works subtotal 土建工程小计	26,300,000
TOTAL CAPEX (include CD) 总投资费	166,717,706	TOTAL CAPEX (include CD) 总投资费	95,738,012

两种方案对比总结

Content 内容	O3+GAC 臭氧+活性炭滤池	Actiflo Carb 微砂循环高效加炭 沉淀池
Capex 总体投资	高	低
OPEX 运行费用	低	高
占地	多	少
运行安全性	较弱	常规
管理运行复杂程度	较复杂	常规

V - Project Reference

工程实例

Project Reference 工程实例

Actiflo Carb & Actiflo Carb Twin 微砂循环高效加炭沉淀池

▶ Actiflo Carb 高效池:

- Bouil de Chambon (Commissioning 开车时间: 2009): 13,200 m³/day
- Kermorvan (Commissioning 开车时间: 2009): 8,400 m³/day
- Montry (Commissioning 开车时间: 2010): 12,700 m³/day

▶ Actiflo Twin Carb 双子高效池:

- Lucien Grand (Commissioning 开车时间: 2009): 66,000 m³/day
- Landivisiau (Commissioning 开车时间: 2009): 12,000 m³/day
- Perros Guirec (Commissioning 开车时间: 2010): 9,600 m³/day
- Miré Moranne (Commissioning 开车时间: 2009): 5,300 m³/day
- Aire sur la Lys (Commissioning 开车时间: 2010): 100,000 m³/day
- Parker (Commissioning 开车时间: 2011): 38,000 m³/day

Actiflo Carb Trials – Gatineaux, Summer 2007

微砂循环高效加炭沉淀池试验—Gatineaux, 2007夏



Gatineaux
WTW

Actiflo Carb Trials – Gatineaux, Summer 2007

微砂循环高密度加炭沉淀池试验— Gatineaux, 2007夏

Actiflo Pre-Treatment

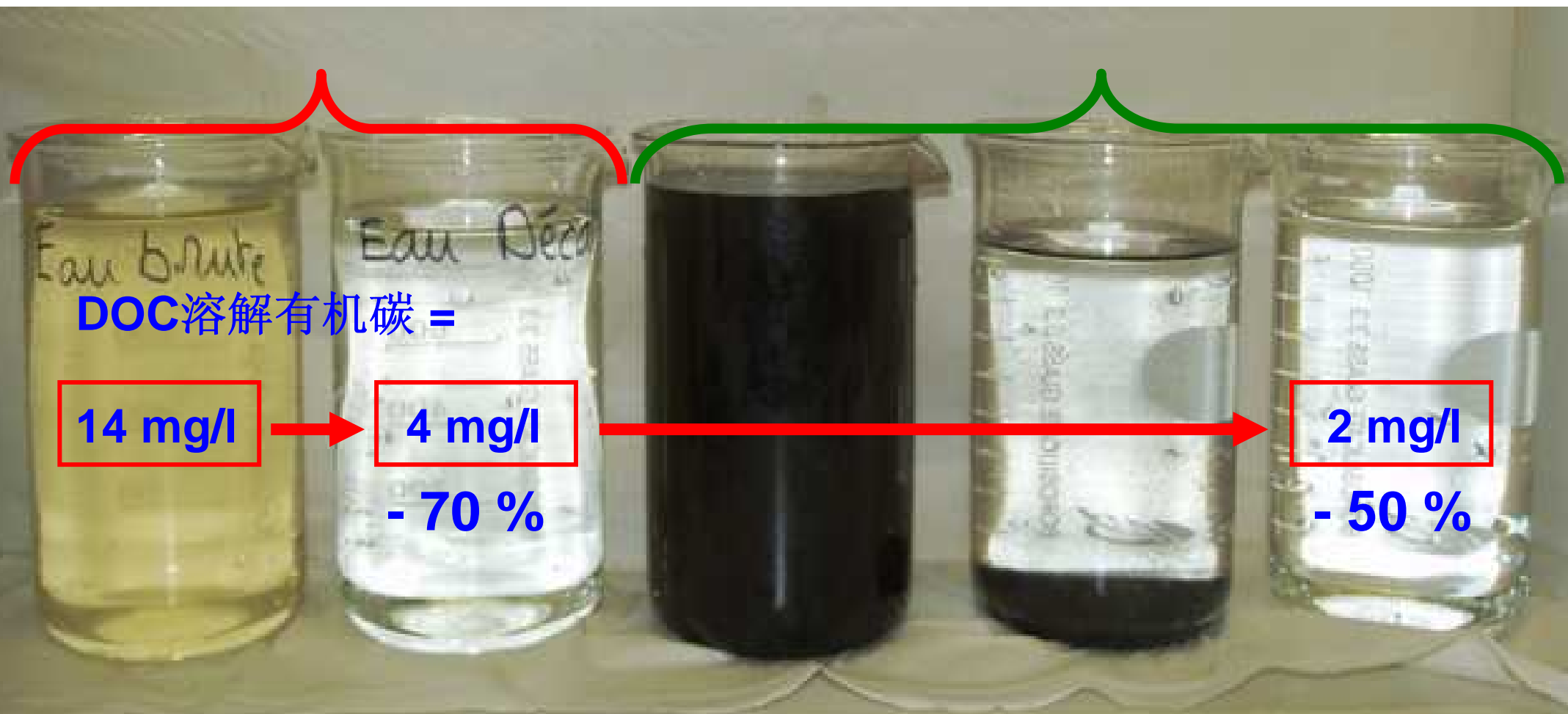
微砂循环沉淀池预处理

With FeCl_3 , pH = 5.0 – 5.5

Actiflo Carb Treatment

微砂循环高密度加炭沉淀池处理

PAC Dose 粉末活性炭投加量 = 3 mg/l

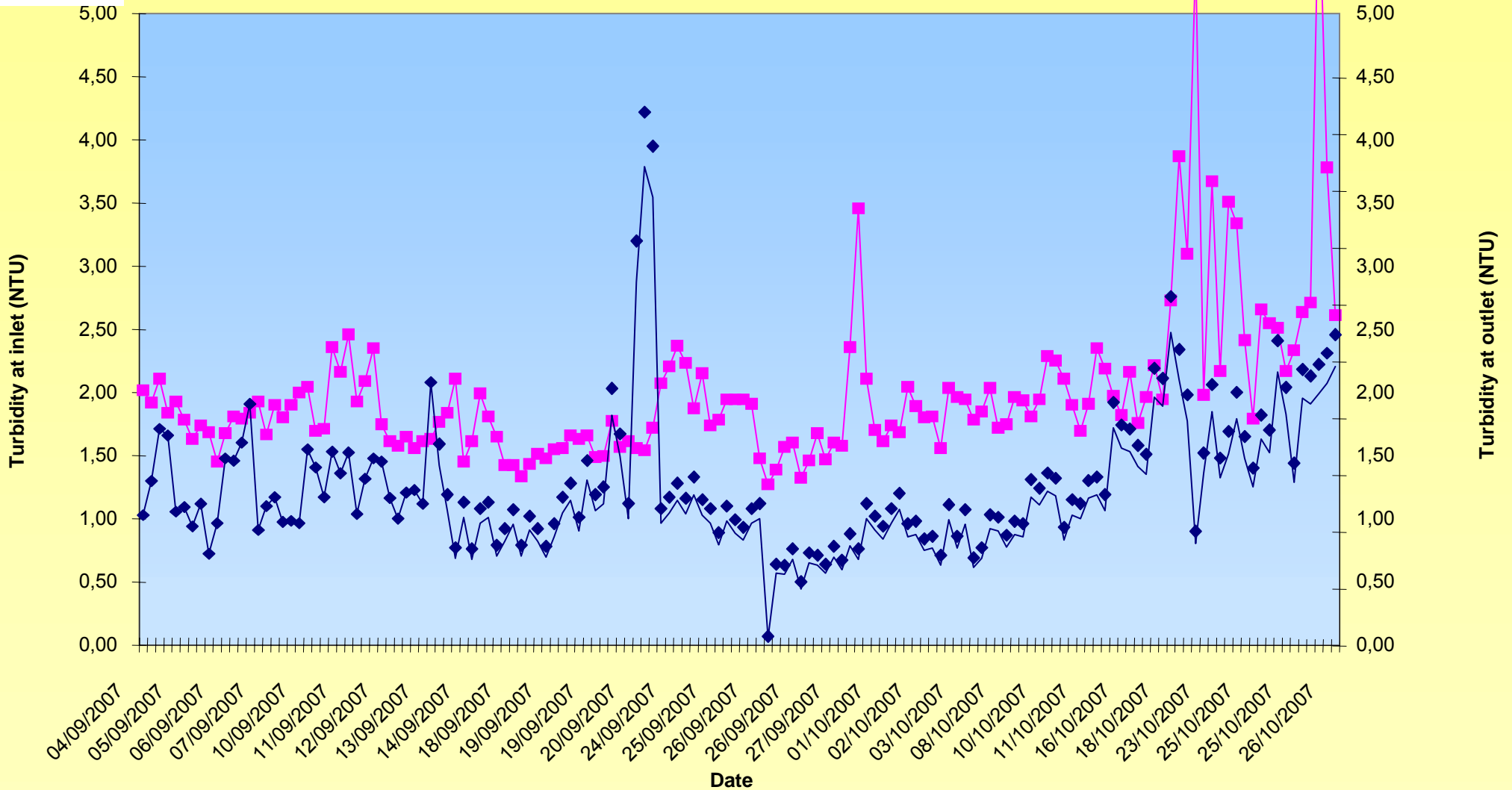


Actiflo Carb Trials at Gatineaux – Turbidity Removal

位于Gatineaux的微砂循环高密度加炭沉淀池试验—浊度去除



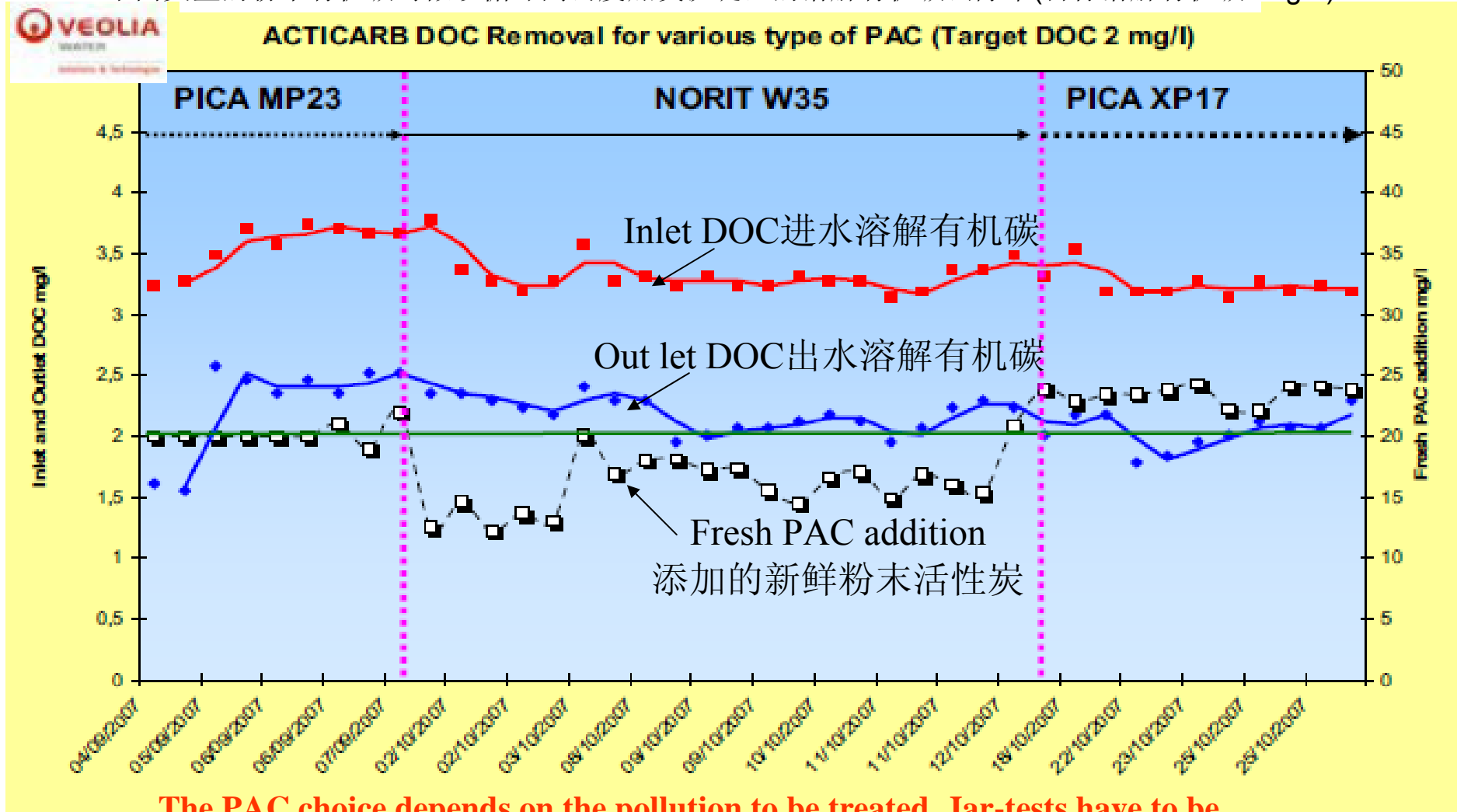
Actiflo + PAC Trials – Gatineaux WTW微砂循环高密度加炭沉淀池试验—Gatineaux
 Turbidity – Turbidity meter Gâtineaux lab浊度—浊度仪Gâtineaux实验室



■ Turbidity at inlet- before filtration 过滤前进水口浊度
◆ Turbidity at outlet - before filtration 过滤前出水口浊度

PAC character – Result of Gatineaux France 粉末活性炭性质—Gatineaux France的成果

不同类型的粉末有机碳对微砂循环高密度加炭沉淀池的溶解有机碳去除率(目标溶解有机碳2mg/L)



The PAC choice depends on the pollution to be treated. Jar-tests have to be run to determine which grade of PAC is best for this specific application and the convenient dosage.

粉末活性炭的选择取决于被处理的污染物。

必须进行烧杯试验来决定哪个类型的粉末活性炭是最适合这个特定的应用和常规剂量

Actiflo Twin Carb at Parker, CO, USA (2008)



▶ Parker, CO – 10 MGD (38,000 m³/d)

- > High DOC content water
高溶解有机碳含量

▶ Treatment Options Considered

供考虑的处理方法选择

- > Ceramic Membranes 陶瓷膜
- > MIEX (Magnetic Ion Exchange resin) + Ceramic Membranes
MIEX (磁离子交换树脂)+陶瓷膜
- > Actiflo Carb with PAC use + Ceramic Membranes
微砂循环加炭高效池+陶瓷膜

Paramete 参数	Value 数值	Unit 单位
DOC 溶解有机碳	7 - 15	mg/L
UV 254 紫外吸光度	0.15 - 0.2	cm ⁻¹
Turbidity 浊度 *	10 - 30	NTU
Hardness 硬度	111 - 190	mg/L
Alkalinity 碱度	114 - 156	mg/L
Iron 铁	0.11 - 16	mg/L
Manganes 镁	0.005 - 0.2	mg/L
pH 酸碱度	8,5	-
<ul style="list-style-type: none"> • During Rain events up to 300 NTU 下雨期间升至300NTU 		

► Ceramic Membranes 陶瓷膜

- > Flux 流量 → 90 gfd (153 lm^2h)
- > Backwash interval 回流间隙 → 60 min
- > Coagulant / Dose 混凝剂/投加量 → FeCl_3 : 100 mg/L

DOC Removal

溶解有机碳去除率

50%

► MIEX + Ceramic Membranes

磁离子交换树脂+陶瓷膜

- > Flux 流量 → 90 gfd (153 lm^2h)
- > Backwash interval 回流间隙 → 60-90 min
- > Coagulant / Dose 混凝剂/投加量 → FeCl_3 : 100-120mg/L

DOC Removal

溶解有机碳去除率

50% - 60%

► Actiflo Carb + Ceramic Membranes

微砂循环高效加炭沉淀池+陶瓷膜

- > Flux 流量 → 90 gfd (153 lm^2h)
- > Backwash interval 回流间隙 → 60 min
- > Coagulant / Dose 混凝剂/投加量 → FeCl_3 : 100 mg/L
- > PAC Type / Dose 粉末活性炭类型/投加量 → PICA MP 23/10-60mg/L

DOC Removal

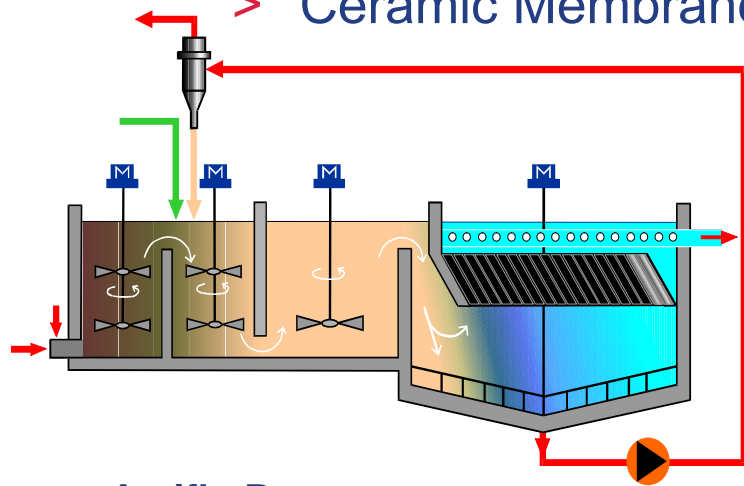
溶解有机碳去除率

60% - 70%

Parker, CO, USA

► Full Scale Design:全面设计

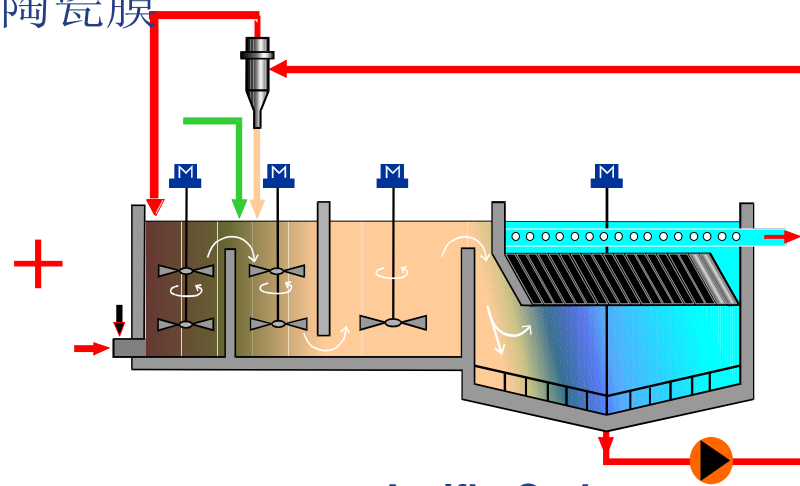
- > Raw Water DOC原水溶解有机碳 = 15 mg/l
- > Actiflo with Enhanced Coagulation at pH 5.5
酸碱度5.5时加有增强混凝作用的Actiflo微砂循环高效沉淀池
- > Actiflo Carb with 20-30 mg/L PAC dose
投加量20-30mg/L粉末活性炭的微砂循环高密度加炭沉淀池
- > Ceramic Membranes陶瓷膜



Actiflo Pretreatment

微砂循环沉淀池预处理: 70%

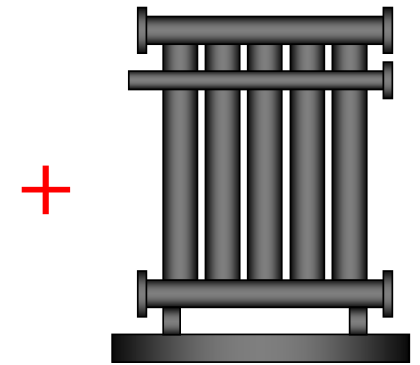
→ DOC溶解有机碳 = 4.5 mg/l



Actiflo Carb

微砂循环高密度加炭沉淀池: 50%

→ DOC溶解有机碳 = 2.25 mg/l



Ceramic Memb.

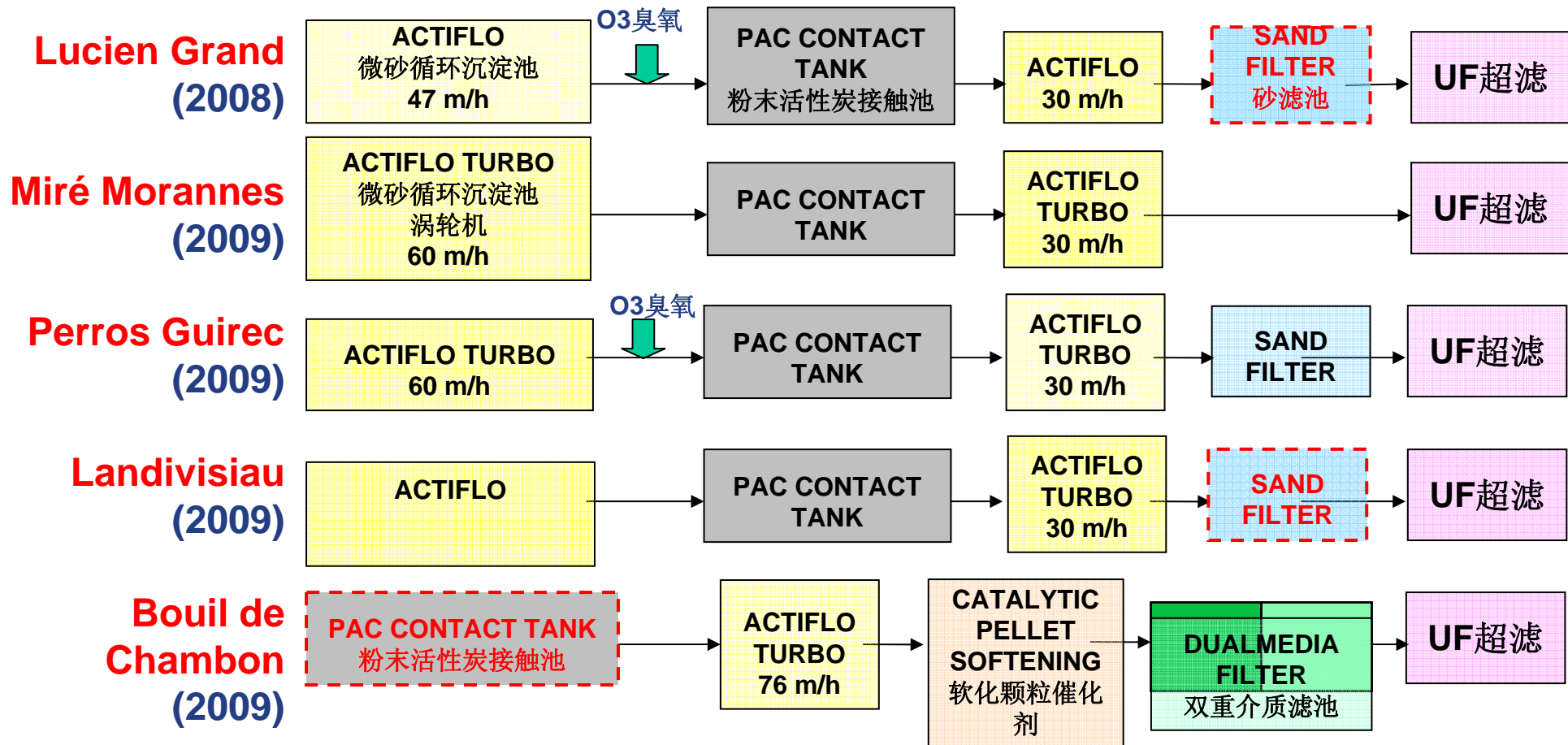
陶瓷膜: 10%

→ DOC溶解有机碳 = 2 mg/l



Selected Actiflo Carb Plants under Construction

选定的微砂循环高效加炭沉淀池工程实例



Thank you
谢谢