CHEMICAL POLLUTION MITIGATION MEASURES – FROM ENGINEERING PERSPECTIVE

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Scope of Presentation

1. Pollution issues on rivers
2. Pollutant threat and impact to water bodies
3. Strategic measures to mitigate pollution
4. Effluent management to overcome pollution
5. Case studies in wastewater treatment technology at UPM





POLLUTION ISSUES ON RIVERS

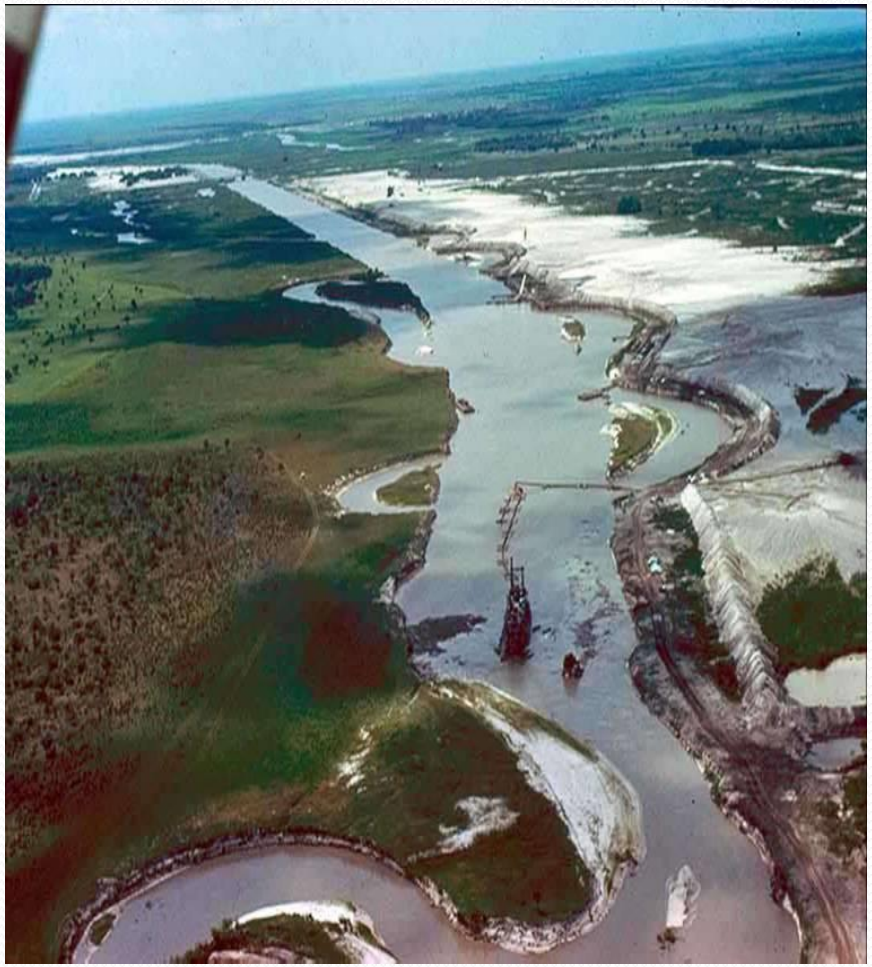
- River pollution in urban catchment is the result of many contributing factors.
- Domestic wastewater discharge, including sullage account for most of the organics that pollute our waterbody.
- About 75% of the pollution in rivers – due to domestic wastewater load, which require urgent attention.

Conflicting uses of river

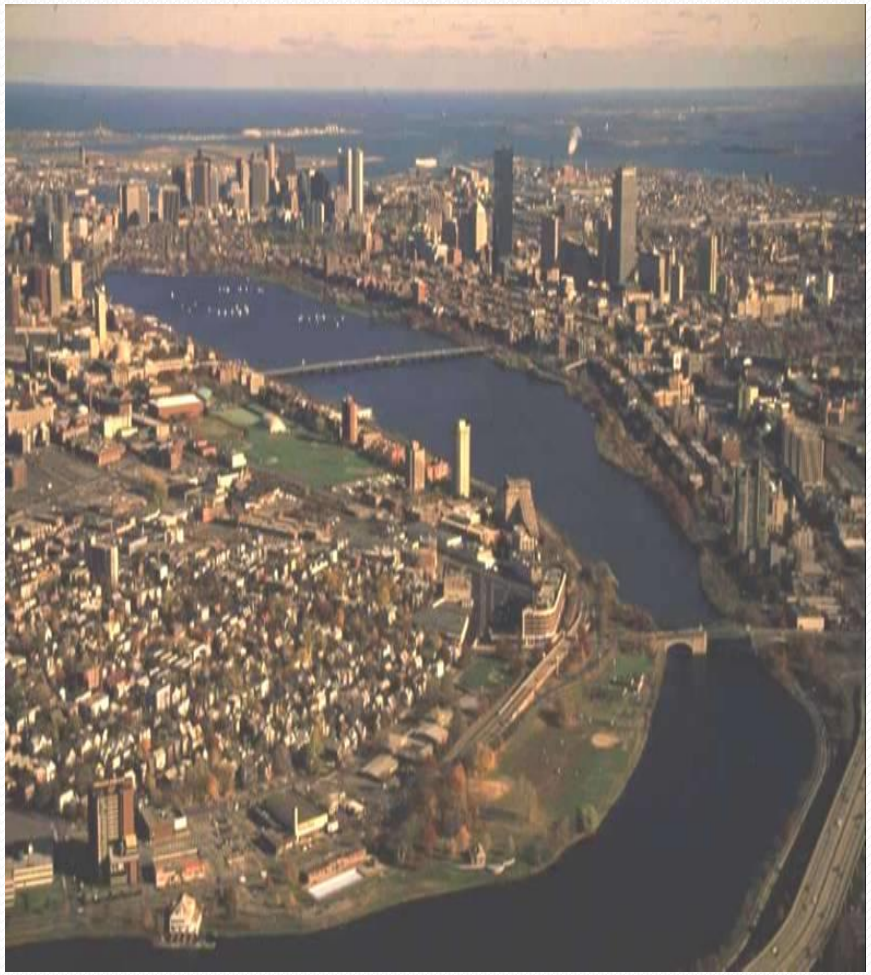
- Potable water supply
- Fisheries
- Irrigation (agriculture)
- Transportation
- Power generation
- Recreation
- Waste disposal

TRUE FOR ALL CITIES

The Past .....



The Present .....

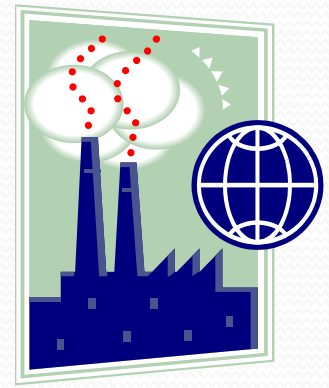


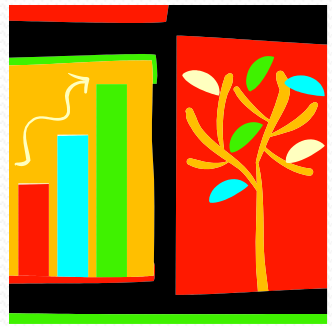
Human settlement – always find the river as DISPOSAL point

Parameters in **chemical pollutants** which frequently exceeded

Class III limits of Rivers are:

- Ammoniacal Nitrogen,
- Organic Carbons,
- Heavy Metals,
- Oil and grease.





Source: National Water Resources Study 2000-2050 (EPU, 2000)

TOP ISSUES:
Problems of wastewater in urban areas

- River pollution due to sewage discharge
- Block drains due to fat, oil and grease (FOG)
- Sullage management
- Drinking water supplies deteriorated
- Treatment issues : organic vs chemicals

Pollution Issues in the Media


KOSMO!

KHAMIS 18 SEPTEMBER 2014 • RM1 • BIL:16 TAHUN 10 PP13809/08/2012 (030437) www.kosmo.com.my

kembali solo 37-39

249 pengarah syarikat gagal lunas tunggakan caruman KWSP dihalang keluar negara

PEGAWAI Jabatan Imigresen akan bekerjasama menyekat pengarah syarikat yang degil daripada membayar caruman berlepas ke luar negara. – Gambar hiasan

LAPORAN DI MUKA 3

Rakyat Malaysia bazir makanan

8 juta kilogram sehari

Jika dikumpulkan, sisa makanan di negara ini boleh dihidangkan kepada kira-kira 2.2 bilion manusia

RAKYAT Malaysia membuang sisa makanan berjumlah lapan juta kilogram sehari yang jika dikumpulkan boleh memberi makan kepada enam juta manusia sehari.

Jumlah itu jika dikumpulkan

2.2 bilion manusia di seluruh dunia.

Secara perbandingan, jumlah sisa makanan dalam sehari itu mampu menyamai ketinggian bangunan Menara Berkembar Petronas (KLCC) setinggi 88

Awam, Datuk Ab. Rahim Md. Noor berkata, kos untuk menguruskan sisa makanan itu mencecah berbilion ringgit setahun.

"Peratusan komposisi sisa makanan didapati meningkat sebanyak 15 hingga 20 peratus

Markas ajaran sesat Hakikat Insan digempur 6

Warga Scotland tentukan masa depan negara itu hari ini 48

Which one?
….. Chemical Pollution
….. Organic Pollution

- Pelupusan sisa makanan (8,000 tan/hari - 2013)


10 • NASIONAL

ISU LONGKANG TERSUMBAT

Denda RM100,000 sumbat longkang

» *Pusat disaran ambil alih fungsi PBT gagal hukum premis*

Pelbagai pihak memberi pandangan masing-masing dalam menangani isu pengurusan sisa pepejal. Ada yang mahu pegawai atau kakitangan PBT yang bersikap lepas tangan dikenakan tindakan tatatertib. Ikuti pandangan mereka menerusi siri kedua pembongkaran BH mengenai isu berkenaan.

Oleh Fairuz Zaidan, Nor Fazlina Abdul Rahim, Tuty Haryanti Ahmad Rodzi, Mohd Fahmi Mohd Yusof, Poliana Ronnie Sidom dan Baharom Bakar

kamah di Negeri Sembilan, mengikut Akta 672.

Katanya, PPSPPA memandang serius kesalahan membabitkan pembuangan sisa pepejal yang mengotorkan kawasan awam kerana ia boleh menjejaskan usaha pem-

- Kos pelupusan sisa (RM 2 bil/tahun)
- Banjir kilat
- Pencemaran sungai

NST:
Sg Klang turns orange in colour

Pollutant Threat and Impacts to Water Bodies

Organic matter & ammonia in sewage

Level of pollution of a river is always judged by the **colour**

Oily and grease wastewater in urban area (Sullage)

Car wash

Workshop

Restaurant

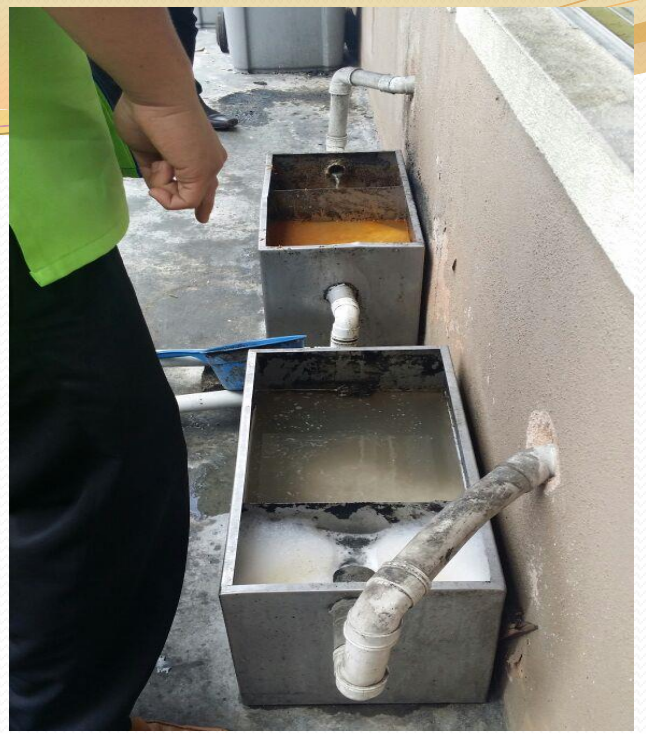
Oil and Grease Pollution coming from our homes

Parameters	Effluent Standard mg/l	FOG waste (kitchen) mg/l	Raw Sewage (toilet) mg/l
pH	6 – 9	5.8	6.5
COD	120	64,000	450
O&G	5	1,250	90
AN	10	420	30
TS	50 (SS)	4,200	720

Problems of Grease Traps

Small tank – overloading

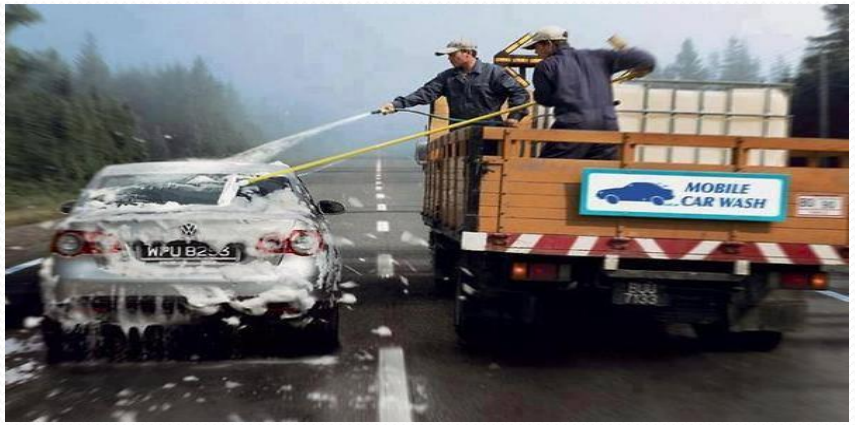
Never desludge



PROBLEMS OF CAR WASH WASTEWATER

- Effluent release has no limit
- Chemical Pollution is visible
- Odour release in open drains
- Oily waste clog drains

Common misunderstanding on car wash and auto workshops



- Pollution from car wash is negligible
- Use of washing detergent/chemical is never being regulated
- Car wash uses small quantity of water
- Auto workshop does not release liquid effluent

Impact of Ammonia Nitrogen to the water supply

- Rivers are badly polluted due to high AN in domestic wastewater
- Increase chlorine demand in water treatment
- AN deplete oxygen level in water bodies
- Phosphorus can lead to the development of undesirable aquatic growth
- AN causes toxicity to fish

EFFLUENT MANAGEMENT TO OVERCOME POLLUTION

Identification of pollutant types

- organic vs chemical
- harmless vs toxic

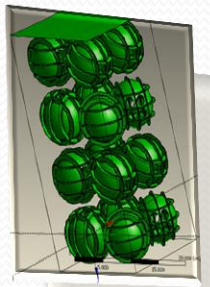
Design of treatment system

- biological treatment
- physical-chemical treatment
- cost evaluation

Effluent Best Management Practices

- Reduce, recycle, reuse
- zero discharge
- adoption of Green technology

Case Studies of Wastewater Treatment Technology at UPM



Case study 1

Organic removal & ammonia issues

Case study 2

Pollution related to Oil & Grease

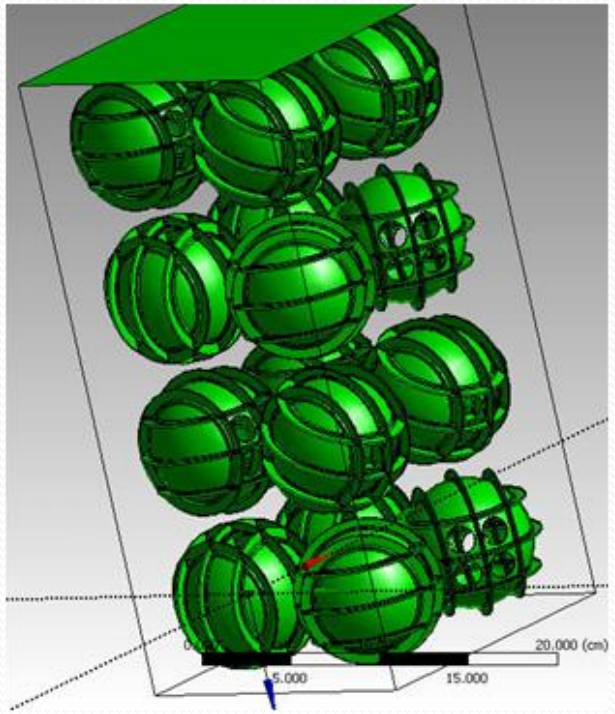
Case study 3

Pollution related to colour in Textiles

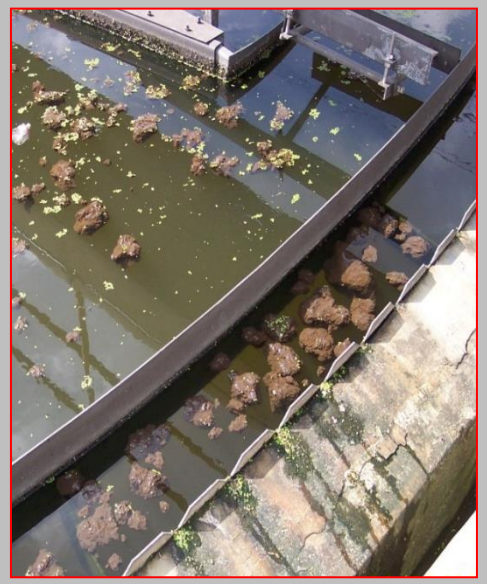
How innovation and technology are able to solve pollution problems

CASE STUDY 1

SEWAGE TREATMENT SYSTEM
USING AERATION IN COSMOBALLS PLASTIC MEDIA
(BIOFIL TECHNOLOGY)



COSMOBALLS

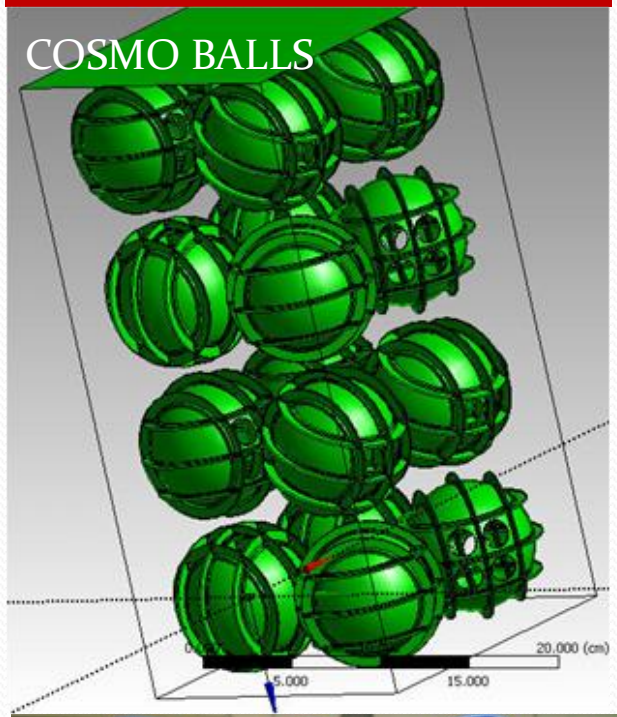


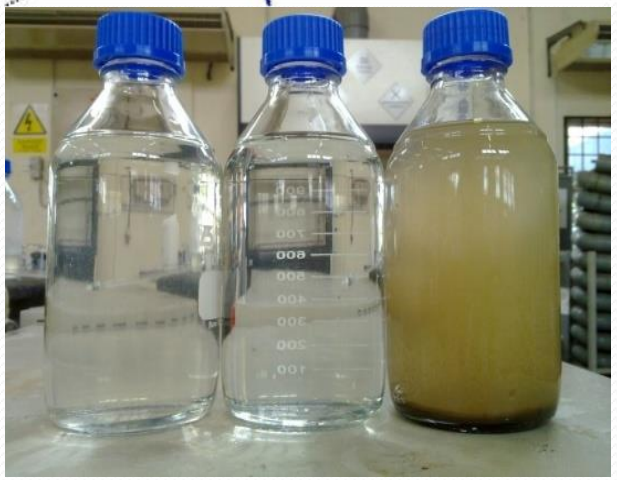
PROBLEMS WITH RIVERS

SERIOUS WATER POLLUTION

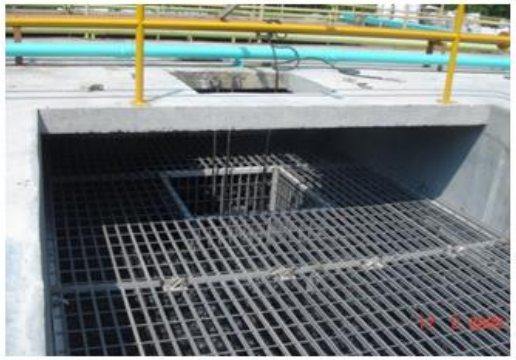
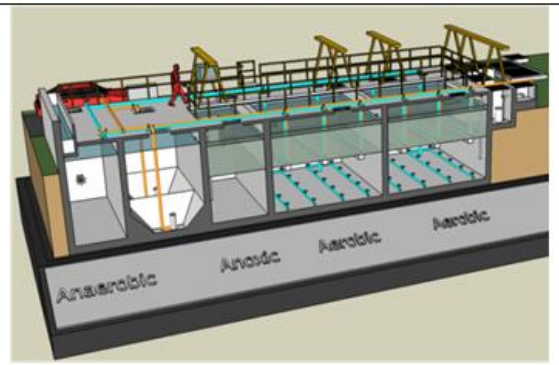
INNOVATIVE PRODUCT

COSMO BALLS

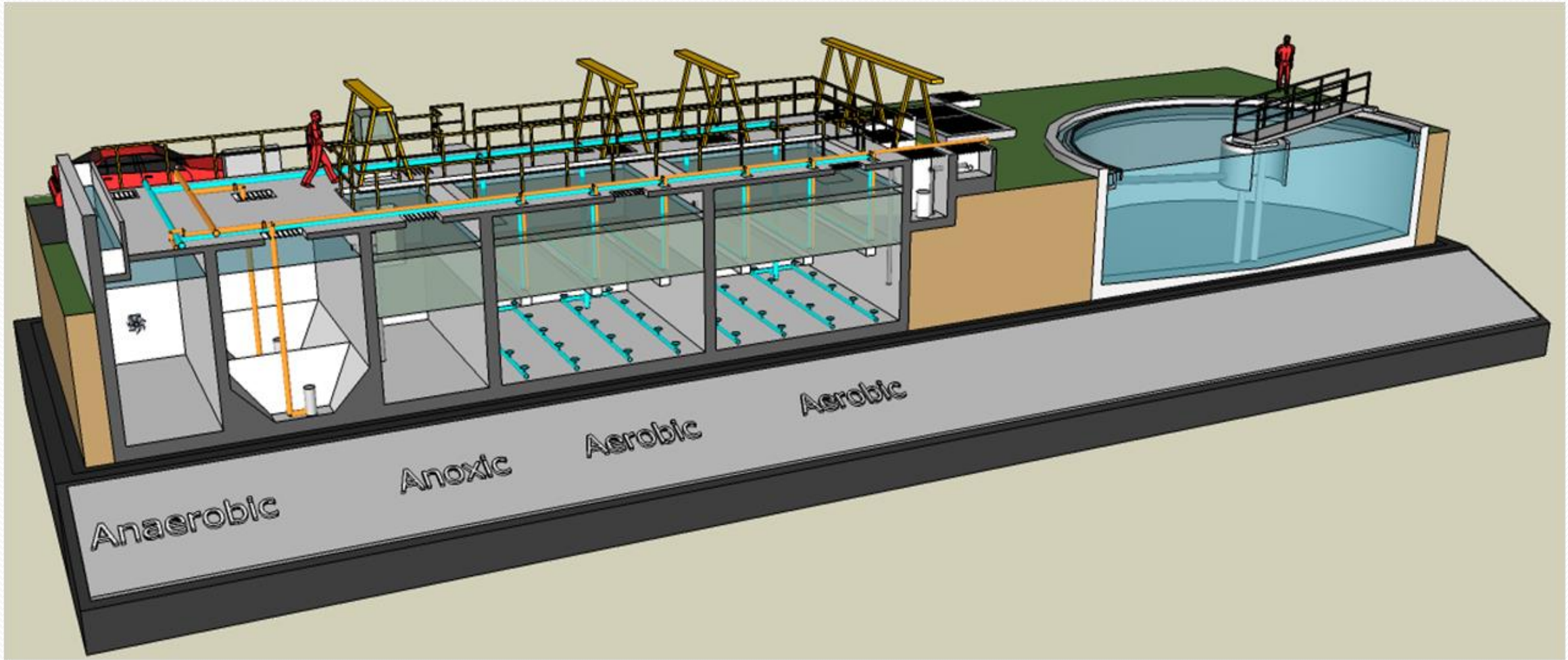




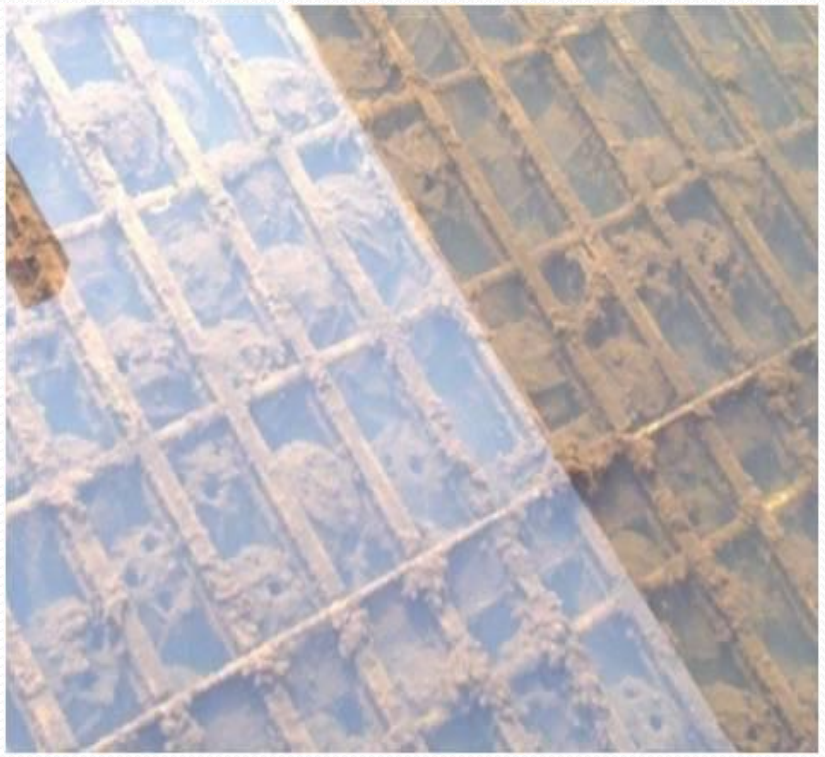
The innovative solution

No	Product Component	Descriptions
1.		Cosmo balls plastic media are 80mm in diameter, the same size as tennis balls. It will be packed into cages to be submerged under water in the treatment plant. Microbes will grow on them, creating a biofilm layer.
2.		The fibre-glass cage containing cosmo-balls create high microbial population for treatment to occur.
3.		The complete system is called BioFil technology. It has 3 main compartment: anaerobic, anoxic and aerobic zones.

BIOFIL TECHNOLOGY - REMOVAL OF POLLUTANTS **WITHOUT CHEMICALS**

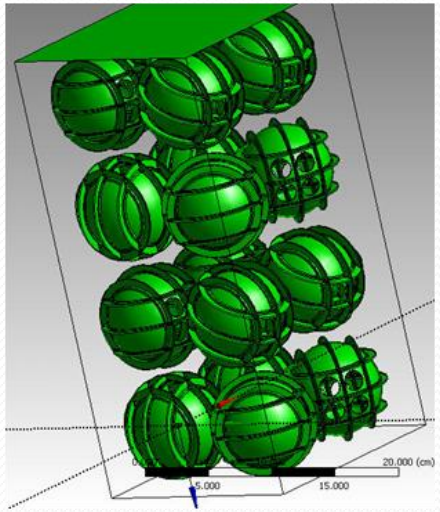


EFFECTIVE TREATMENT OF AMMONIA



Treatment of pollution WITHOUT CHEMICAL – very effective at high pollution load

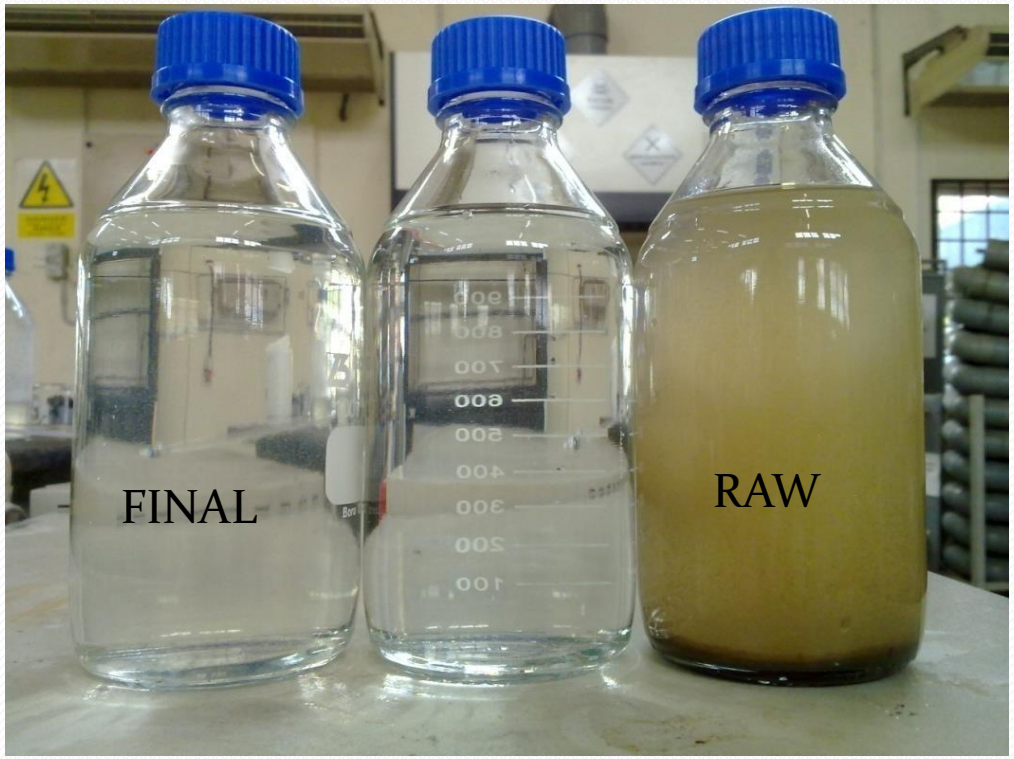
BioFil STP Fabrication is completed -cosmo-balls are secured in a cage



Success Story

Highly effective treatment process able to remove Ammonia N to less than 3 mg/l.

A compact system (50% smaller) - only 12 hours, vs existing 24 hours tank.



Excellent Performance
Less than 3 mg/l Ammonia Nitrogen
Highly effective for river clean-up

Success story

Capacity: 3000 PE (600 home)	BioFil STP	Conventional STP	Advantages of BioFil
STP Cost (Capex)	1.78 m*	1.9 m	less 6%
Operating cost (RM /year)	115,056	159,180	less 27%
Total built up area - actual (m^2)	1736	2226	Less 22%
Buffer area (m^2)	627	542	extra 16% ($85m^2$ = 915 sq ft)

* Cost may vary, depending on location and details

CASE STUDY 2

POLLUTION STUDY OF WASTEWATER FROM FOOD OUTLETS, CAR WORKSHOP AND CAR WASH CENTRES

Kementerian Kesejahteraan Bandar, Perumahan Dan Kerajaan Tempatan (KPKT)

DR NIK & ASSOCIATES SDN BHD

JABATAN PENGAIRAN DAN SALIRAN MALAYSIA

SPAN

PROJEK:
KAJIAN PENCEMARAN AIR DARIPADA PREMIS MAKANAN, BENGKEL & PUSAT BASUHAN KENDERAAN DI KAWASAN PROJEK RIVER OF LIFE (ROL)

KETUA PERUNDING: PROF DR AZNI BIN IDRIS

Analysis of Grease Trap – Individual Type

Restaurants	O&G	BOD	COD	SS	P	TN	NH_3	pH
	mg/L							
DBKL								
Nasi Kandar Pelita (influen)	204	1400	4758	2994	15.7	23.8	2.8	4.7
Nasi Kandar Pelita (efluen)	12.7	927	3151	48	15.7	21	2.4	4.8
Saloma Bistro & Theatre Restaurant (influen)	2616	17266	58705	66184	13.2	277	423.1	4.2
Saloma Bistro & Theatre Restaurant (efluen)	7.9	156	498	72	5.3	22.4	17.4	6.1
MPS								
JK Restaurant (efluen)	224	7228	23130	12948	9.9	23.0	1.2	4.7
JK Restaurant (efluen)	15.7	946	3028	566	13.5	45.4	2.3	5.3
Pizza Hut (influen)	26.3	854	2734	2066	4.4	37.0	0.81	4.6
Pizza Hut (efluen)	7.6	622	1989	1390	3.4	19.6	0.58	5.1
Average effluent	11	696	2258	403	11	31	5	5
Influent to STP (SPAN)	50	250	500	300	10	50	30	5-9

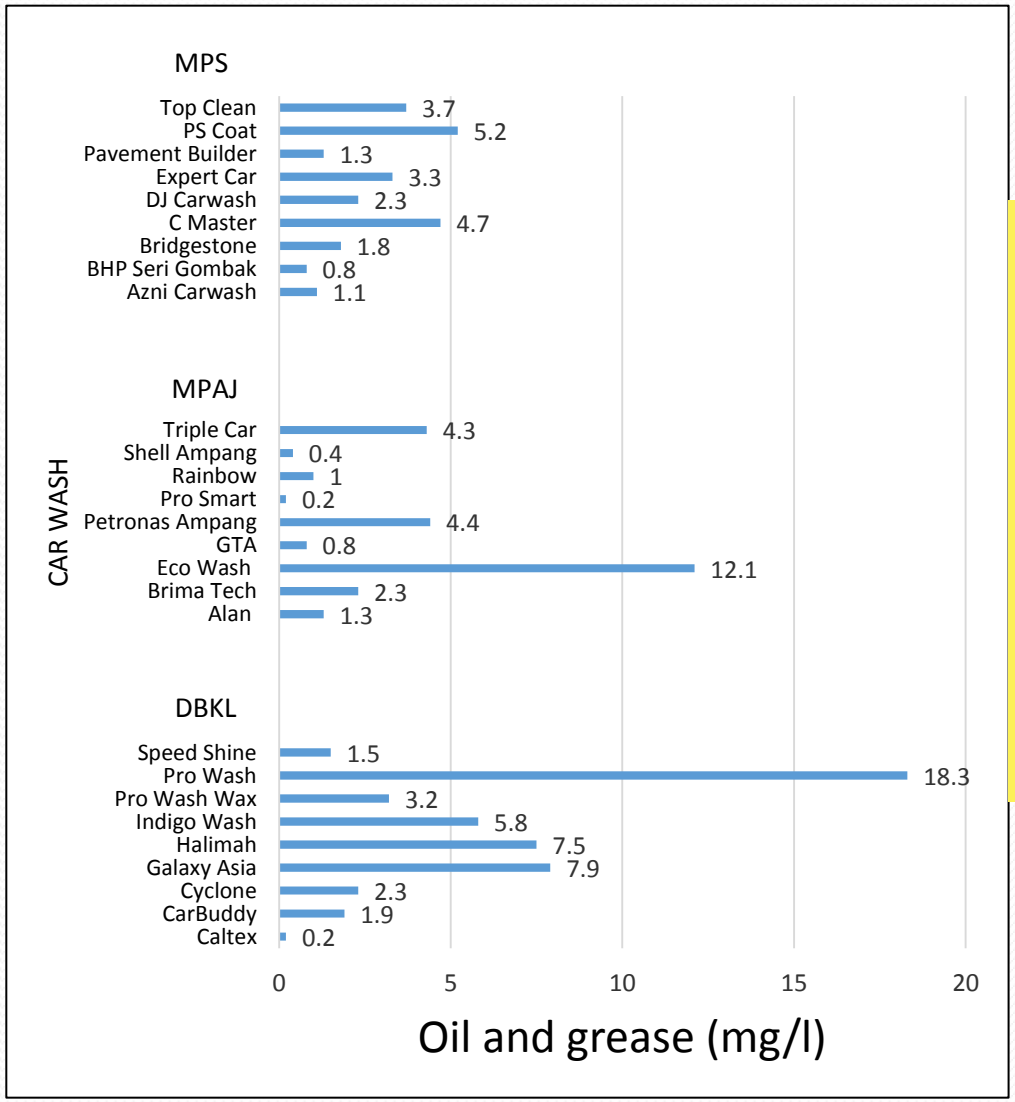
Max. 50 mg/l O&G

Analysis of Grease Trap – Communal Type

Restaurants	O&G	BOD	COD	SS	P	TN	NH_3	pH
	mg/L							
DBKL								
Suria KLCC (influen)	18.7	2738	8762	8394	45.6	314	184	5.2
Suria KLCC (efluen)	17.6	218	697	146	7.8	38	9.4	6.4
Medan Selera Taman Tenaga (influen)	105	11010	35231	104142	19.4	336	32	4.8
Medan Selera Taman Tenaga (efluen)	2.9	180	576	120	13.4	5.6	4.8	5.3
MPS								
Medan Sengkuap (influen)	12.9	802	2567.9	796	11.7	16.0	1.15	4.6
Medan Sengkuap (efluen)	5.3	248	794	114	16.8	24.9	2.3	4.6
Medan Selera Pasar Selayang (influen)	7.5	257	823	118	9.9	23.0	9.3	4.7
Medan Selera Pasar Selayang (efluen)	2.1	192	613	80	6.2	27.2	10.7	5.1
Average Effluent	6.2	178.8	572	107.7	8.7	18.0	5.0	5.3
Influent to STP (SPAN)	50	250	500	300	10	50	30	5-9

Max. 50 mg/l O&G

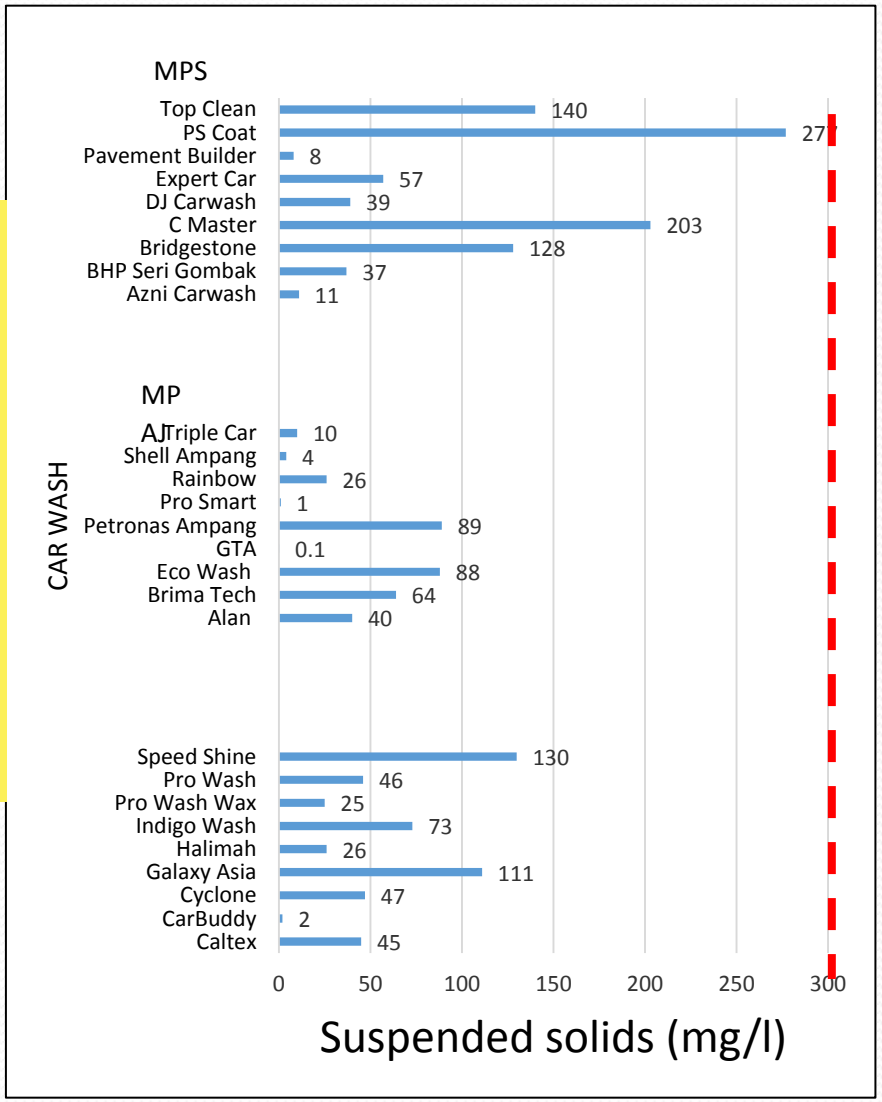
CAR WASH – Oil and grease/suspended solids



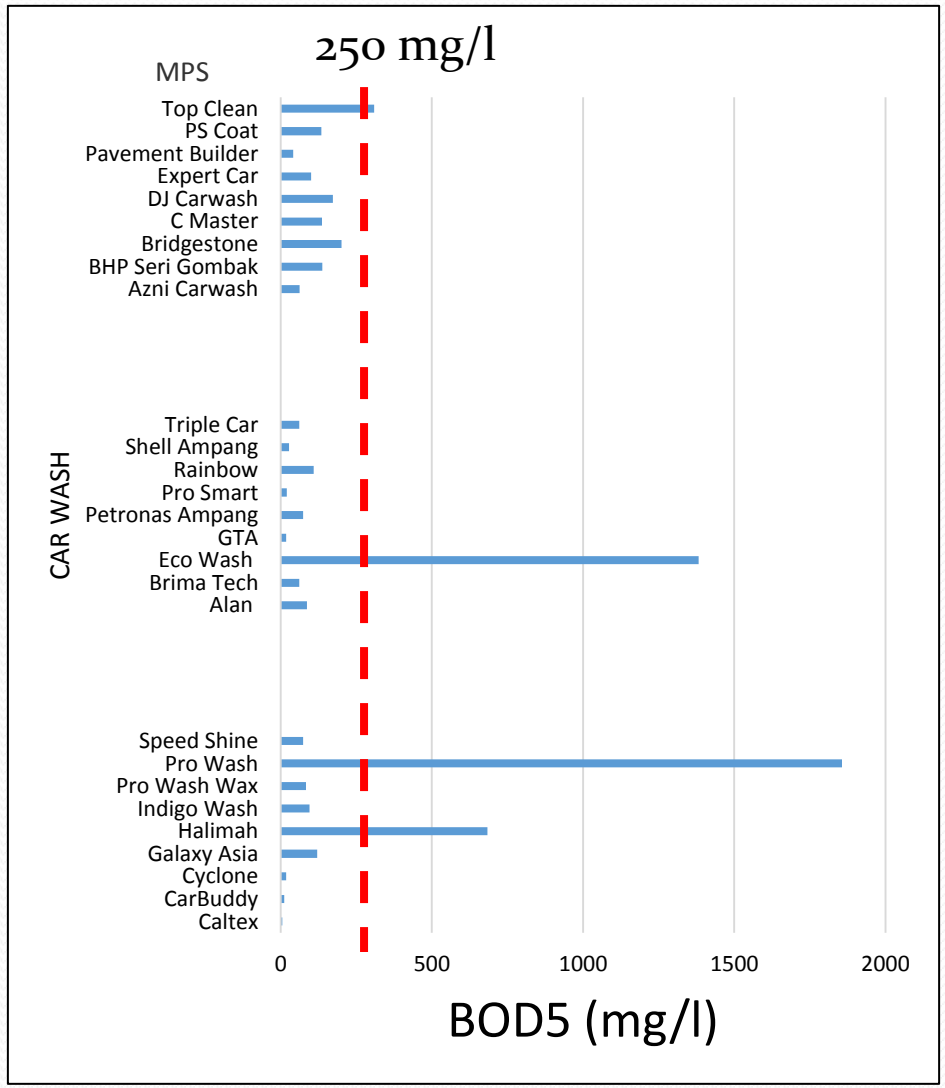
Average:

- O&G: 3.7 mg/l
- BOD: 225 mg/l
- COD: 735 mg/l
- SS: 64 mg/l

- TP: 2.5 mg/l
- TN: 6.4 mg/l
- NH_3: 1.1 mg/l
- pH: 7.2



CAR WASH – BOD and COD



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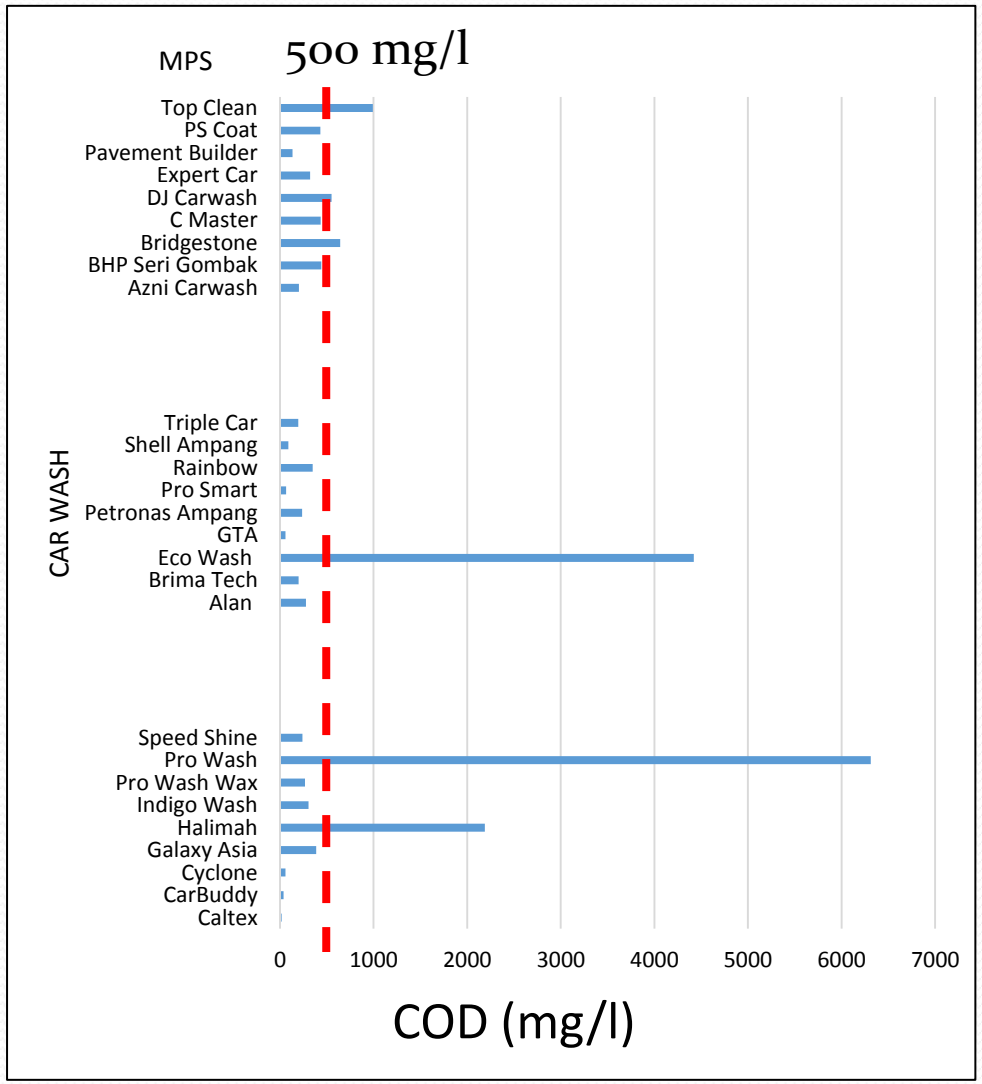
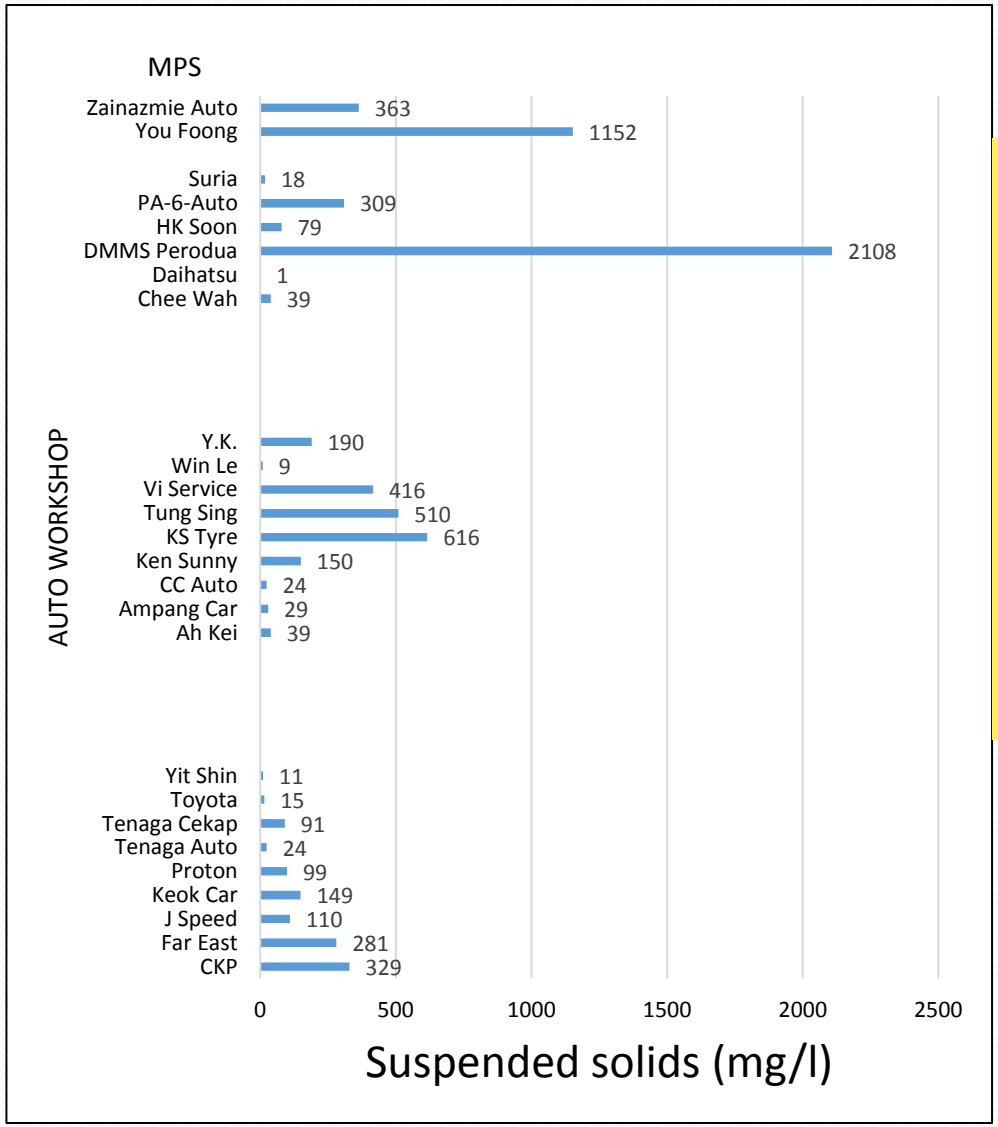


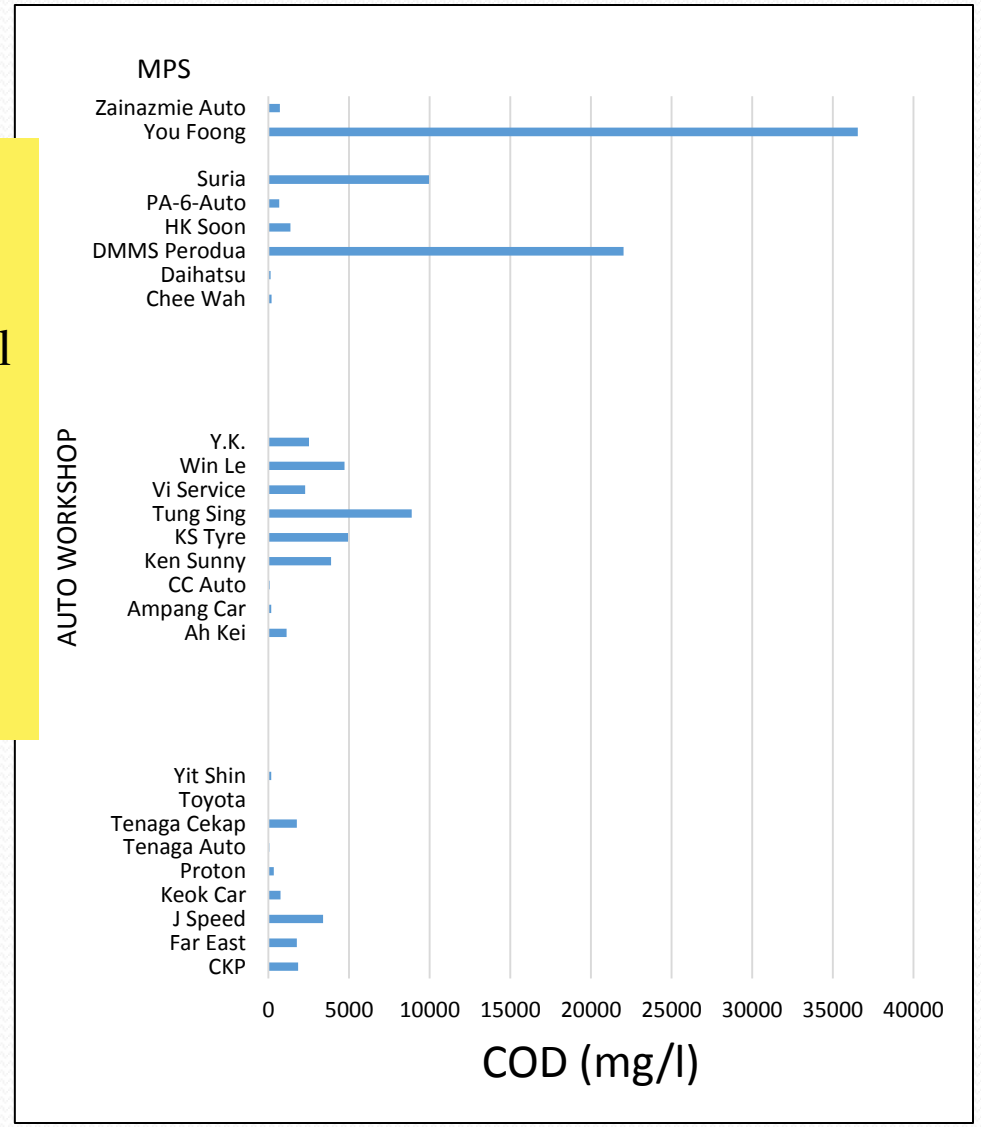
CAR WORKSHOP – suspended solids and COD



Average:

- O&G: 11.5 mg/l
- BOD: 1,316 mg/l
- COD: 4,241 mg/l
- SS: 275 mg/l

- TP: 12.9 mg/l
- TN: 12 mg/l
- NH3: 2 mg/l
- pH: 9



Engineering solution to Enforce Effluent Regulation

- Grease traps to be mandatory at all food outlets
- Mandatory connection of grease traps to **sewer system** – No discharge to drains
- Suitable size grease traps with adequate volume to be approved by LA
- Desludging requirement needed at regular frequency of 2 weeks

- Car wash centres to have effluent management and grease traps
- Car workshop to implement washwater management, apart from use lube oil collection

CASE STUDY 2

BIOREACTOR FOR TREATMENT OF HIGHLY- COLOURED WASTEWATER

TOP DOWN, NATIONAL BIOTECH WORKING GROUP
Development of Bioremediation Processes for Industrial Wastewater
(Ministry of Science, Technology and Environment)
Program No: 03-01- 01-001 BTK/ER/020

Colours in Textile Effluent

486 PtCo

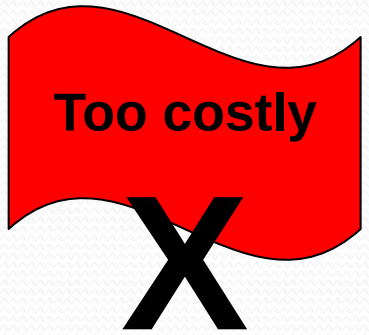
680 PtCo

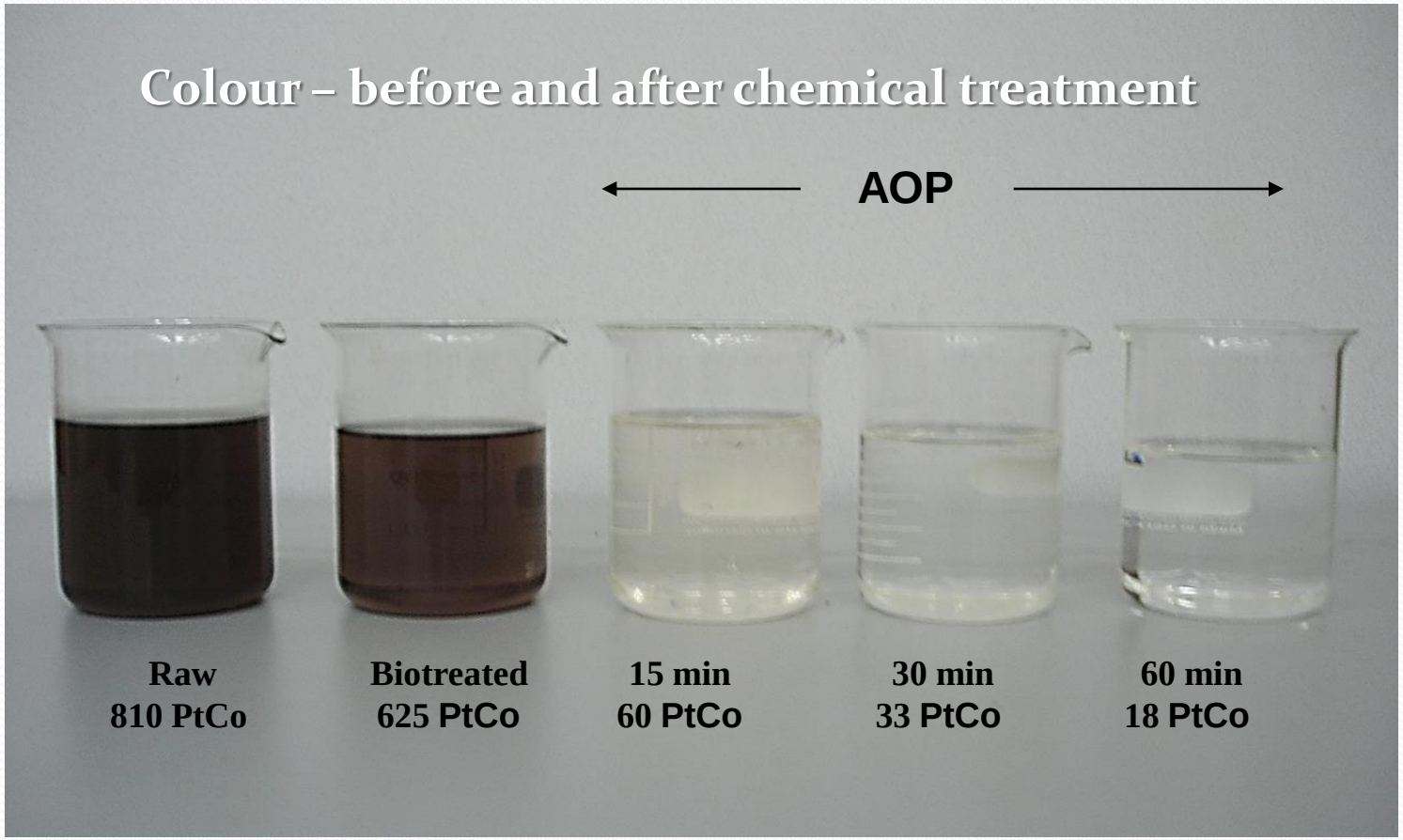
1744 PtCo

6175 PtCo

CHEMICAL TREATMENT

Effective using ozone, peroxide and UV, but it is



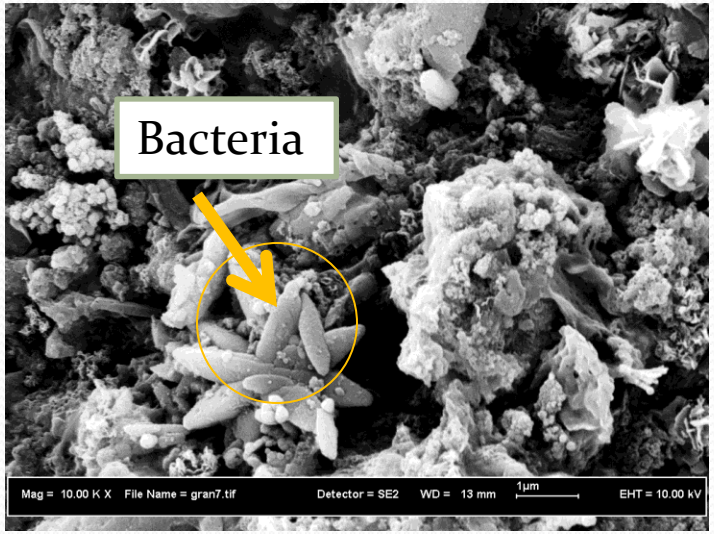


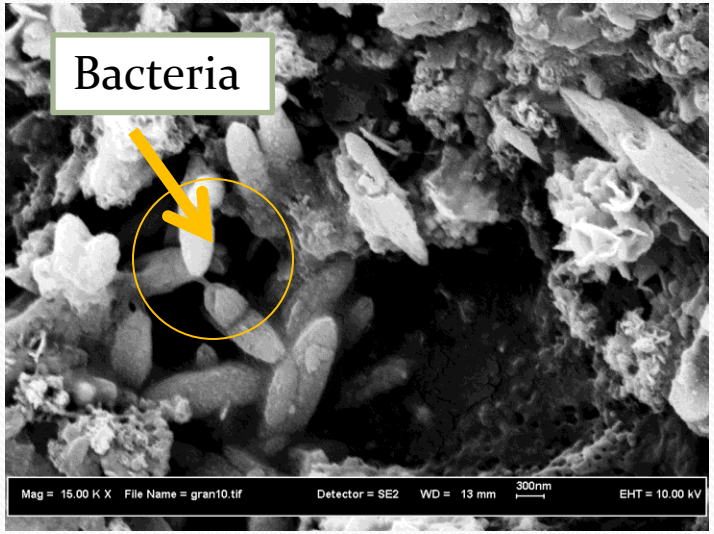
Colour removal system using bacteria

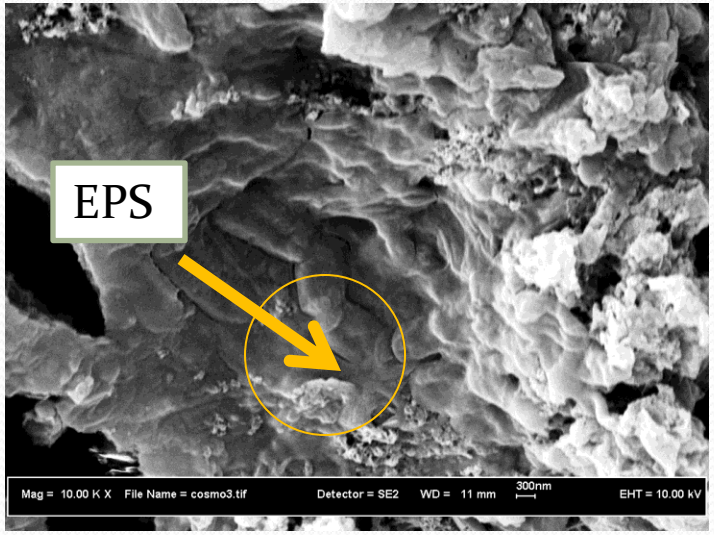
Preparation of *MicroClear* Inoculum

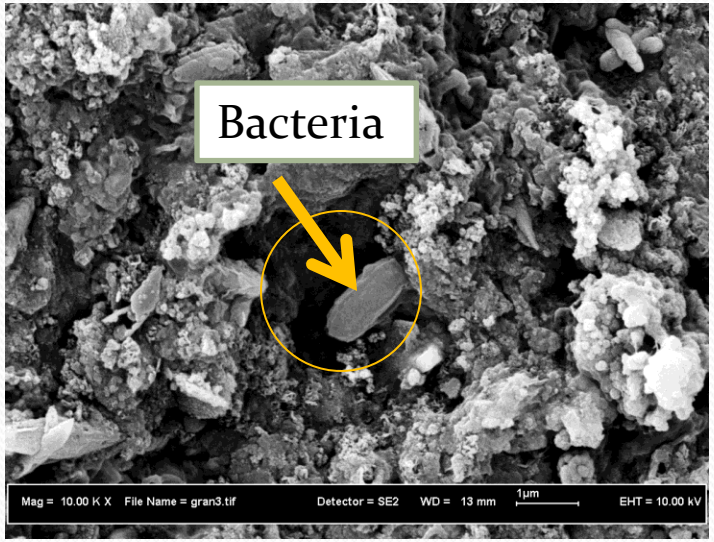
Bioreactor Added with *MicroClear*

SCANNING ELECTRON MICROGRAPH

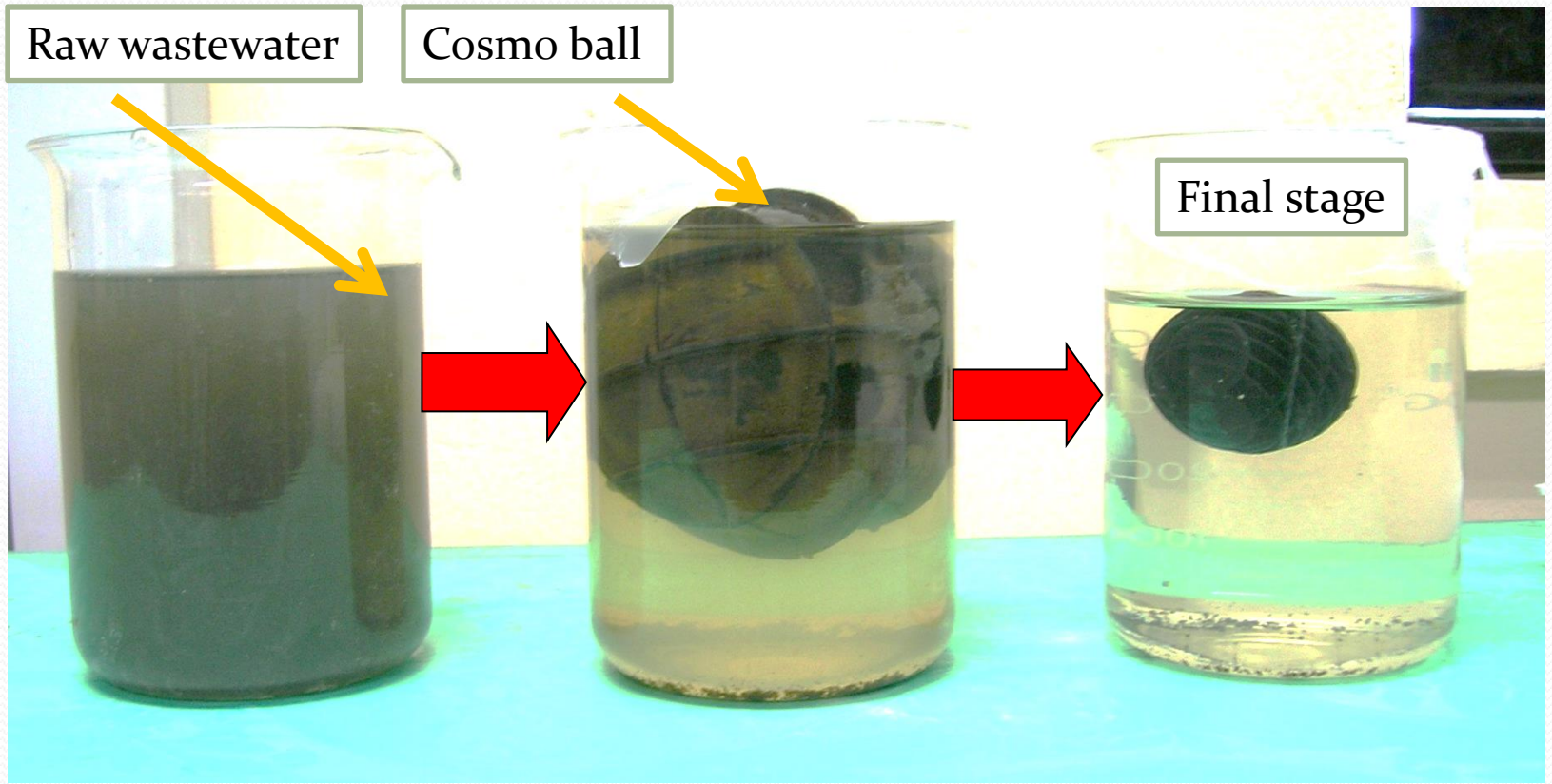








MicroClear PERFOMANCE

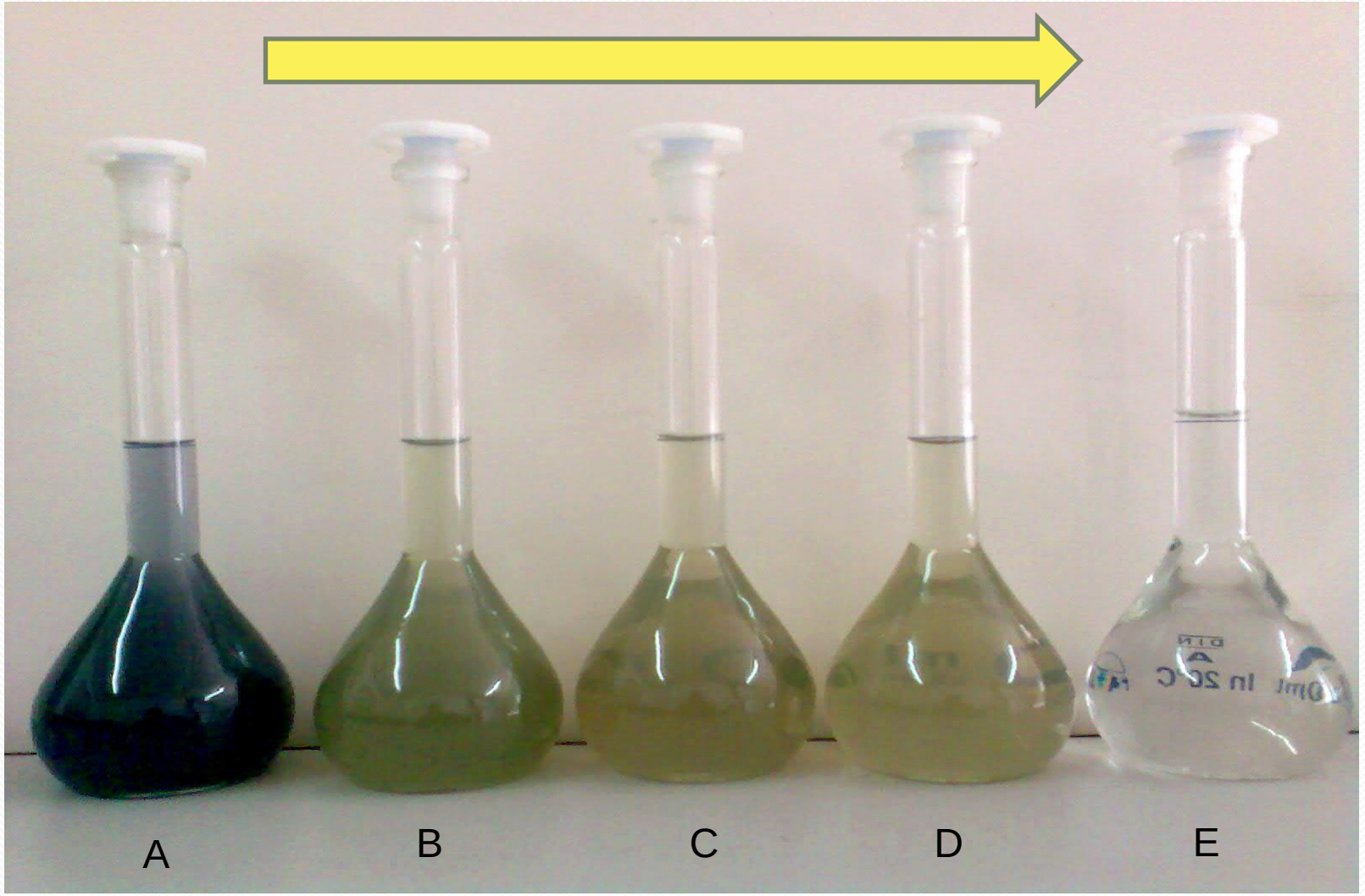


Raw **AFBR** **SBBR**

3 steps treatment cycle

Colour removal using biological treatment of textile effluent

A (raw),
B (anaerobic),
C (aerobic),
D (after aerobic) and
E (final discharge)



- New method
- New process
- No chemical use

CONCLUDING REMARKS

- Chemical pollution is a serious threat to our rivers and water body
- Proper treatment are needed using engineering solutions, and best management practices
- Minimise the use of chemicals in wastewater treatment
- Innovative technologies must be created to offer cost effective system

Thank you

Q&A

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