

Eflo EC Electro Coagulation

EfloEC Benefits

- No Process Chemicals
- Minimal operator input
- Effective on a very wide range of difficult to treat waste water
- Effective on waste waters with combined contaminants
- Alternative to chemical treatment processes such as DAF
- Auto regulation operation dependent on contaminant concentration
- Consumable items are sacrificial metal plates available from steel stock holders.
- Non leaching oxide sludges produced
- Produced sludges are easy to de-water without polymers
- Very high efficiency with removal rates often in excess of 99 %
- High capability on difficult to remove pollutants such as pesticides and herbicides.
- High performance pre-treatment to other processes such as membrane treatment
- Exceptional capability as post treatment polishing
- High kill rates for bacteria, viruses & cysts without chemicals

General Description

Electro Coagulation (EC) is a process that has been in existence since the last century with the first patent being issued in 1906. However, it is only recently that the process has been fully developed & commercialised to a level where it has become a very effective, **chemical free**, means of economically treating a wide variety of challenging waste waters.

Eflo are the appointed agents for Powell Water Systems EC equipment. Powell Water Systems, who can be considered a global leader, have more than 25 years experience in designing, installing and operating EC treatment systems worldwide.

90 m3 per hour
Electro Coagulation
Plant for Toshiba



EC is an electrical treatment process and requires no process chemicals such as flocculants and polymers. Almost all chemical dosing treatment processes can be replaced by EC with the elimination of the consumable chemical costs.

Existing DAF systems can be retained for the clarification step but the chemical dosing process can be replaced with the EC process.

EC can be used for many industrial applications demand waste water treatment including those below and is available from 1.0 m3/hr upwards.

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|--|--------------------------------|
| Food including dairy, meat, fish, vegetable & fruit processing | Textile & dye. |
| Food oil. | Mining. |
| Industrial oily waters. | Coal washing. |
| Metal plating. | Construction material washing. |
| Metal harvesting. | Membrane pre-treatment. |
| Produced water. | Boiler make up water. |
| Radio-active isotope removal. | Ground water clean up. |
| Sludge dewatering. | Anti-Freeze cleaning. |
| RO Pre Treatment. | Surface water cleaning. |
| Silica removal. | Dredging. |
| Algae (Red Tide) removal. | Water treatment. |
| | Pressure washing & car wash. |

Eflo - About Us

Eflo International Ltd, UK. Designer and of advanced wastewater treatment systems.

Eflo has designed & installed treatment plants in the Middle East, Africa, Caribbean the Indian Ocean islands over a period of more than 30 years.

As well as the **EfloEC** Electro Coagulation, **Eflo** offers a range of other innovative waste water treatment products and water recycling systems.

Eflo is part of the Concorde Corodex Group of companies and through this group can offer bespoke, potable, water treatment plants including River Water Treatment and Seawater Reverse Osmosis. Water treatment plants for small communities to large towns.

EFLO Processes :

- EfloCT** Extended Aeration
- EfloSAF** Submerged Aerated Filter
- EfloSBR** Filandraw Sequential Batch Reactor
- EfloMBR** Membrane Bio-Reactor
- EfloDAF** Dissolved Air Floatation
- EfloSEP** Oil Water Separation
- EfloEC** Electro - Coagulation
- EfloGREY** Grey Water Re cycling
- EfloOdour** Bio & Chemical Odour Control

Exclusive Agents for:

- Fosco** Autoclaves for Solid Waste Treatment & Recycling
- Ekoton** Screens & Sludge de-watering equipment
- Powell Water Systems** Electro Coagulation

The Electro Coagulation Process

The Electro Coagulation process (EC) has been in existence for decades but it has taken technological advances and a realisation that an alternative technology to commonplace the chemical dosing is viable and acceptable. Powell Water have more than twenty years experience of EC development and reference sites across a very wide range of industries and now delivers EC systems tailored to each customer's individual treatment requirement. Standard treatment units are used for flow rates and various internal blade materials and power delivery systems are used.

The Powell EC system consists of flat metal blades placed parallel to one another. Screened, untreated water is introduced to the base of the chamber housing the metal blades. The location of the blades across the chamber and vertically within the chamber and the residence time ensure the flow of water is dispersed evenly as it moves upwards through the blades.

Once the chamber is flooded and flow is passing, a direct current is applied to the first and last blade in the chamber. The flowing liquid then becomes a conductor, allowing the electrical current to pass freely throughout the chamber. This results in a flood of electrons passing into the water which neutralise charged particles causing them to precipitate out of solution.

In addition, the metal blades react to the current by releasing charged metal ions which act in a similar way to chemical coagulants.

The EC units also is equipped with an air purge system to help fluidise precipitates, polarity reversing to extend blade life and prevent contaminant coating and an auto clean-in-place system.

No chemicals are required in the treatment process. The acid solution used in the clean-in-place system is recycled and when exhausted, is passed through the EC for final disposal.

Occasionally, some waste waters may required a pH alteration to remove specific contaminants and Eflo can advise on this if necessary.

Ancillary Equipment

The metal blades are set at a small 3 mm gap. It is therefore important that the incoming water to be treated is pre-screened to less than 3mm. Eflo can advise on the various screening options.

If the waste water includes high levels of sediments, free oils etc, it is most beneficial to removes the bulk of these prior to the EC process using regular settlement and oily water separators.

Post EC, the precipitates require separation from the clean water. This can be achieved using various clarification processes depending upon the quality requirement of the treated water. Conventional settlement to ultra filtration membrane systems can be employed.



125 m³/hr twin lane EC system followed by Ultra Filtration clarification and Reverse Osmosis for the recycling of process water back to potable quality in an electronics factory, Korea.

The two EC units are show to the left of the photo, with their associated power supplies. The UF membranes are submerged type in the blue process tanks and these provide the initial clarification. The RO membranes for delivering potable water are the the horizontal membranes shown to the right of the photo.

This is a typical waste water treatment and re-cycling process that can be adapted to a very wide range of industries looking to recover and re-use their waste waters.

Typical Operating Costs

Beside operating personal, the other costs are largely electricity and periodic metal blade replacements.

The power consumption is typically 1 kWh per every cubic meter of water treated.

The metal blade consumption is around 23 grammes per every cubic meter of water treated. These flat metal blades are generally stock metal and can be purchased locally. Normally, each EC unit include two power terminal blades which are available from Eflo.

Waste Sludge

Most contaminants are precipitated as oxides which render them as non-hazardous and enables them to pass leaching tests to prove the waste sludge is inert. These tests include: The USA EPA Toxicity Characteristic Leaching Procedure (TCLP), the German DIN Leaching Test and the UK BS EN 12457. By passing these tests, the sludges can be accepted as inert for disposal to landfill at lower charges.

When comparing chemical coagulation with electrical coagulation, the cost of chemicals vs electricity and metal blades is the cost analysis. Typically, the capital and operating costs of EC are significantly less than chemical coagulation.

But when the waste sludges and their treatment and disposal are examined, the EC process offers very significant benefits over chemical treatment.

- * Chemical treatment is a additive process increasing the dissolved solids in the water making it expensive to reuse, whereas, EC reduced the dissolved solids by up to 60%.
- * Sludge production from chemical treatment can be double that produced by EC.
- * Chemical precipitated sludges are generally caustic above pH10 and the metals in the sludge are in a hydroxide form, which is considered hazardous as they will become soluble again at the natural pH7 range.
- * Unlike chemical precipitated sludges, EC produces oxide sludges which readily de-water without the addition of expensive chemical polymers.

12 m3 per hour EC unit complete with power supply and all skid mounted



Clients

Alcan Int Ltd Canada, Alfa Appliance Service Colorado, Anadarko Petroleum Wyoming, Apex Processing Systems Australia, Aquamanz California, Associated Plating California, AWEA Colorado, BacTee Systems N. Carolina, Boeing Arizona, Clean Waters South Korea, Beijing Wall Investment, China, Chilena de Tabacos Chile, Burlington Engineering California, Carige Water Technology Puerto Rico, Colorado Energy Management New Mexico, Consolidated Meats Group Australia, Dong Lim Industrial South Korea, Doosan Industrial South Korea, EC Systems Thailand, EC & P Korea, Eco Dewell Int Arizona, EcoGeo South Korea, El Paso Electric Co Texas, Electro Chemical Finishing Michigan, Flagship Ecosystems Singapore, Gerber Pumps Int Florida, IGB Vetsch Switzerland, Ilen Seafoods Ireland, Inland Empire Oilseeds, Washington, Integrastra Mexico, Intel Oregon, JC Engineering Taiwan, LIG South Korea, NEAT Environmental Canada, Newalta Corp Canada, RAK Gas Commission UAE, Sam Chang Foundry South Korea, Sammis Oil & Gas Canada, Samsung SDI Cheonan South Korea, Samsung SDI Pusan South Korea, Santa Clara Waste Water California, Southern California Water Co California, Separation Process Technologies Japan, Shihlin Electric & Eng Corp Taiwan, Sustainable Industrial Development Pakistan, TSS Filtration Services Texas, US Army Research Pennsylvania, US Navy California, Vermont Organics Reclamation Vermont, Waste Water Treatment Ass Colorado, World Water Works New York and others..

Eflo EC Electro Coagulation

Typical Contaminant Removal Performance of EC

Contaminant	Before EC (mg/l)	After EC (mg/l)	Removal (%)
Aldrin (Pesticide)	0.0630	0.0010	98.40
Aluminum	224.00	0.69	99.69
Ammonia	49.00	19.40	60.41
Arsenic	0.076	< 0.0022	97.12
Barium	0.0145	<0.0010	93.10
Benzene	90.10	0.359	99.60
BOD	1050	14.0	98.67
Boron	4.86	1.41	70.98
Cadmium	0.1252	<0.0040	96.81
Calcium	1321	21.4	98.40
Chlorieviphos (pesticide)	5.87	0.03	99.50
Chromium	139.0	<0.010	99.92
Cobalt	0.1238	0.0214	82.71
Copper	0.7984	<0.0020	99.75
Cyanide (free)	723.0	<0.020	99.99
Cypermethrin (pesticide)	1.30	0.070	94.60
DDT (pesticide)	0.2610	0.0020	99.20
Diazinon (pesticide)	34.00	0.210	99.40
Ethyl Benzene	428.00	0.3720	99.91
Flouride	1.10	0.4150	62.27
Gold	5.72	1.380	75.87
Iron	68.34	0.1939	99.72
Lead	0.590	0.0032	99.46
Lindane (pesticide)	0.1430	0.0010	99.30
Magnesium	13.15	0.0444	99.66
Manganese	1.0610	0.0184	98.27
Mercury	0.720	<0.0031	98.45
Molybdenum	0.350	0.0290	91.71
MP-Xylene	41.60	0.0570	99.86
MTBE	21.58	0.0462	99.79
Nickel	183.0	0.070	99.9
Nitrate	11.7	2.6	77.78
Nitrite	21.0	12.0	42.86
Nitrogen TKN	1118.88	59.08	94.72
NTU	35.38	0.320	99.10
O-Xylene	191.0	0.416	99.78
PCB (Arochlor 1248)	0.0007	<0.0001	85.71
Petroleum Hydrocarbons	72.50	<0.20	99.72
Phosphate	28.00	0.20	99.28
Platinum	4.40	0.680	84.55
Potassium	200.00	110.00	45.00
Peoptamphos (pesticide)	80.87	0.360	99.60
Selenium	68.00	38.00	44.00



RAK Gas commission, UAE. BTEX (Benzene, Toluene, Ethylbenzene and Xylenes) separation.

31 m3/hr EC plant complete with Vacuum Separator.



Samsung South Korea.

145 m3/hr EC plant



Eflo International Ltd

Part of the Concorde Corodex Group of Companies

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