CLAIMS

1. An electrolytic system for abating pollutants in waste water treatment and electrosynthesis of reactants, comprising:

an electrolysis chamber (100) having a configuration comprising at least one anode chamber (101) having a first reactant, at least one cathode chamber (102) having a second reactant,

at least one inlet (103a), for inflow of waste water having oxidable components, for the anode chamber (101) of the electrolysis chamber (100),

at least one inlet (103b), for inflow of wastewater having reducible components, for the cathode chamber (102) of the electrolysis chamber (100),

at least one outlet (104a), for outlet of cleaned-up water with a first type of dissolved gases, from the anode chamber (101) of the electrolysis chamber (100), and

at least one outlet (104b), for outflow of cleaned-up water with a second type of dissolved gases, from the cathode chamber of the electrolysis chamber (100),

said configuration enabling laminar flow of said reactants, the at least one inlet (103) and the at least one outlet (104) being at opposite ends of the electrolysis chamber (100);

at least one anode (105) and at least one cathode (106) configured within the electrolysis chamber (100), wherein the at least one anode (105) and the at least one cathode (106) are non-sacrificial electrodes comprising carbon, resin, and catalyst, wherein entire surface of the anode (105) and entire surface of the cathode (106) is exposed for maximum current to pass through, enabling enhanced flow of said reactants;

at least one membrane (109), being a semi-permeable allowing passage of water molecules but barring majority of dissolved salts,

organics, and bacteria, said membrane separating the anode chamber (101) from the cathode chamber (102), to avoid intermixing of said reactants in the two chambers (101, 102); and

the at least one outlet (104) configured for collecting reusable water, wherein flow is introduced in the electrolysis chamber (100) to accelerate rate of reaction; and

at least an energy source (107), wherein a recycling conduit is connected with electrolysis chamber by means of a recirculation pump (108) for recirculating the waste water.

2. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 1, wherein the anode is a carbon-based electrode comprising graphene, graphite, resin and catalyst made by hot or cold pressing.

3. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 2, wherein said catalyst is selected from a group comprising platinum group metals (PGM metals) as well as transition metals such as copper, ruthenium, palladium, platinum, silver, zinc, molybdenum, graphene, CNTs.

4. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 2, wherein said particulate resin is selected from the group consisting of synthetic resins, pumice, and artificial pellets, phenolic resin, phenol formaldehyde resin, ultra-high-molecular-weight polyethylene, coal tar pitch.

5. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 1, wherein the cathode comprises graphene, natural graphite flakes purified by dilute sulfuric acid process, resin, catalyst, stainless steel or sandwiched stainless steel.

6. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 1, wherein the electrode is Teflon impregnated to

increase the mechanical strength and the anode and the cathode is used interchangeably depending upon the type of waste treatment or the electrosynthesis reaction.

7. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 1, wherein at least one of the anode and the cathode is porous.

8. The system for treating wastewater and electrosynthesis of reactants as claimed in claim 1, wherein the at least one inlet duct and one outlet duct enable controlled oxidation and reduction reaction in the anode chamber and the cathode chamber.

9. The system for treating wastewater as claimed in claim 1, wherein said membrane for separating the anode and the cathode chamber is selected from an ion exchange membrane, reverse osmosis membrane and combinations thereof, with variable pore size less than 1 micron, depending upon the desired waste water treatment and the by product to be separated.

10. The system for treating wastewater as claimed in claim 1, wherein said membrane is of a thin film composite type where the active layer is polyamide (PA) active layer (~50–100 nm thickness), supported by an asymmetric polysulphone support (~30-60 μm thickness).

11. The system for treating wastewater as claimed in claim 1, wherein said non-sacrificial electrodes comprising 95 to 100 % graphite, < 1 % graphene, 0 to 1 % catalyst, resin optional 0 to 30 %, corrosion inhibiting polymer optional 0 to 10%.

12. The system for treating wastewater as claimed in claim 1, wherein said electrodes being separated by an appropriate distance of 1 cm to 20 cm by said membrane separator so that maximum current can be harnessed without compromising safety risk of electrodes touching and or heat generated not getting dissipated,

13. The system for treating wastewater as claimed in claim 1, wherein the energy source is plug in or solar energy for maintaining the voltage in the system.

14. A method for treating wastewater and electrosynthesis of reactants, comprising the steps of:

(a) adding the water to be treated to an electrolyzer chamber wherein said electrolyzer comprises a dimensionally stable graphene anode and a cathode in at least one anode and at least one cathode chamber;

(b) electrolyzing and oxidizing/ reducing the wastewater for lowering pollutants therein by continuously introducing strong electrolytes to the electrolysis chamber for lowering the current, wherein simultaneous oxidation and reduction take place in the anode chamber and the cathode chamber as per the requirement of the by-products in the process;

(c) introducing flow in the chambers, wherein flow is introduced by spargers or gas turbulence for accelerating the rate of reaction; and

(d) collecting by-products, wherein the one of the by product is at least a gas and the generated gas is circulated backto the electrolysis chamber for faster electro chemical process.

15. The method for treating wastewater as claimed in claim 14, wherein the process is made faster by continuously re-circulating the wastewater through a recycling conduit connected with said reactor by means of a recirculation pump.

16. The method for treating wastewater as claimed in claim 14, wherein the strong electrolyte for lowering the current and in turn accelerating the rate of reaction in the electrolysis chamber is selected from a group comprising sodium sulphate, sodium chloride, potassium chloride, potassium hydroxide and combinations thereof.

17. The method for treating wastewater as claimed in claim 14, wherein in step (b) a cathodic current density of about 20-500 A/m^2 is applied to said electrolyzer.

18. The method for treating wastewater as claimed in claim 14, wherein the gases from the waste water is purified gases by means of filters and separation of outlet gas and liquid is by a headspace mechanism.