TECHNICAL NOTES

How the EC Emulsion Cracking System Works

Pan America Environmental, Inc.

EC Emulsions Cracking Systems

System Overview

The EC Emulsion Cracking System (EC Series) is a compact, above-grade, API-421-based steel coalescing oil-water separator designed specifically for breaking stable oil-in-water emulsions in industrial wastewater. It combines physical-chemical treatment with gravity separation in a single linear process tank, making it ideal for applications where free, dispersed, and emulsified hydrocarbons (oils, fuels, and petroleum derivatives) must be removed to low levels (typically <10 ppm with 30-micron droplet removal capability).

Emulsions are colloidal suspensions of one liquid in another (usually oil droplets <20 microns dispersed in water). They form mechanically (via high-shear mixing or pumping) or chemically (stabilized by surfactants, soaps, or detergents). The EC system destabilizes these emulsions through targeted chemistry, separates the released oils/solids, and neutralizes the effluent for compliant discharge.

https://www.panamenv.com/oil-water-separators/ec/

How the EC Emulsion Cracking System Works

The EC system uses a three-stage, continuous-flow process housed in one integrated tank:

1. **Stage 1: Emulsion Cracking (Reaction Chamber)**
   Wastewater enters the first reaction chamber where a chemical demulsifier (acid for simple emulsions or polymers/coagulants/flocculants for complex/stubborn emulsions) is added and mixed.
   - Mechanism: Chemicals alter the electrical charge on oil droplets (typically making them cationic), overcoming the repulsive forces that keep droplets dispersed. This allows small droplets to coalesce into larger ones that can be separated by gravity. The resulting break forms a liquid oil and can be removed by the oil water separator section.
   - Acid cracking is used for less rigorous emulsions; polymers or multi-chemical blends handle surfactant-stabilized or mechanically sheared emulsions that can be broken to a liquid oil.
   - Bench/jar testing is required for each waste stream to determine exact chemistry and dosages.

2. **Stage 2: Product Separation (Coalescing Section)**
   The cracked mixture flows into the coalescing oil-water separator section containing Flopak™ media. Freed oil droplets rise and coalesce on the media plates, forming larger globules that separate from the water.
   - Alternative separation methods (if needed): Dissolved Air Flotation (DAF) for very fine droplets or emulsions that break to a semi-solid/semi-liquid result or Slant Plate Clarifier for sinking solids/flocs.
   - Separated oil is collected in a dedicated oil chamber; any sludge settles for removal.

3. **Stage 3: pH Adjustment (Neutralization Chamber)**
   Because emulsion cracking often lowers pH dramatically, a caustic (typically NaOH) is added in the final reaction chamber to raise the pH back to the 6–9 discharge range.
   - A pH probe and automated chemical dosing ensure precise control.

6007 S. Railroad Street Burlington, WI 53105 USA 262.716.0105 technical@panamenv.com.
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Process Flow Summary

Influent → Emulsion Cracking (acid/polymer dosing + mixing) → Coalescing Separation (oil removal) → pH Neutralization (caustic dosing) → Treated Effluent

Oil/Sludge outlets are provided for recovery/disposal. All stages operate in a single linear tank, minimizing footprint while maximizing efficiency. The system is fully customizable for flow, chemistry, and site requirements.

Key Features

- Proven chemical + physical separation technology
- Flow rates: 5–1000 GPM (standard models; custom available)
- Materials: 304/316 stainless steel, coated carbon steel, or polypropylene/polyethylene
- Flopak™ coalescing media (various plate spacings)
- Integrated reaction chambers, mixers, chemical pumps (acid, demulsifier, NaOH), pH probe, and control panel
- Lifting lugs for easy installation
- Compact, above-grade design saves floor space
- Handles solids and a wide range of hydrocarbons (motor oils, fuels, hydraulic fluids, vegetable oils, BTEX, etc.)

Benefits

- Reliably breaks even difficult emulsions that conventional separators cannot handle
- Achieves low effluent oil levels (<10 ppm typical)
- Single-tank design reduces installation cost and space
- Highly customizable with many options (DAF integration, automation, etc.)
- Economical operation with proven reliability across industries

Typical Applications

- Groundwater remediation
- Refineries & petrochemical plants
- Vehicle/aircraft/military wash racks
- Steel mills & manufacturing process water
- Stormwater treatment
- Shipping ballast & bilge water
- Tank farms & produced/frac water
- Biodiesel plants, heat treating, and latex removal

Note: Exact sizing depends on oil specific gravity, droplet size, and waste stream characteristics. Pan America Environmental performs bench testing and provides full system design support.

Important: Every emulsion is unique. Pan America Environmental recommends laboratory jar testing and/or on-site chemical supplier testing to optimize chemistry and confirm performance before final design.

For a custom EC system quote, detailed drawings, or emulsion testing support, contact Pan America Environmental today. We engineer solutions that work—reliably, efficiently, and cost-effectively. Pan America Environmental – Your One-Stop Shop for Industrial Wastewater Treatment.