









KOLINA[®]

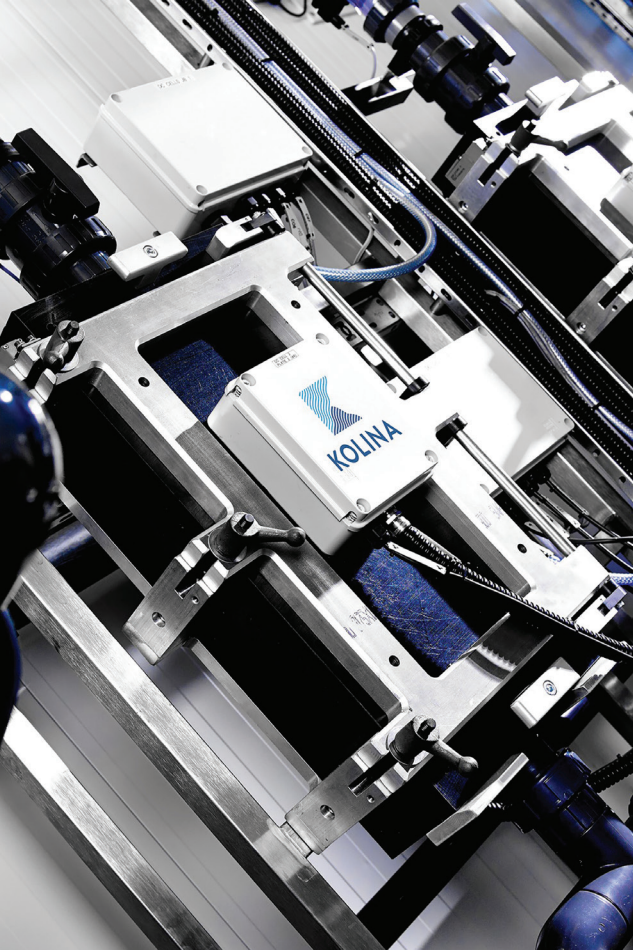
SECTOR BREAKTHROUGH REPORT

Water Company adoption of Kolina's proprietary
Electrocoagulation Technology ("KEC")
for Phosphorous and Nutrients removal

After 3 years of extensive trials¹ in the water utility sector, Kolina's KEC units have proven the capability to:

-  Replace 100% of liquid chemical dosing
-  Deliver 40% reduction in carbon footprint
-  Reduce phosphorus levels to below 0.25mg/l
-  Offer more than 25% OPEX savings
-  Maintain residual ferric levels below 2mg/l
-  Improve the economics of small and rural water sites

This has led to the first fully pre-trialled capital investment in electrocoagulation by a UK Water Company.



1

Proprietary Technology

Kolina's patented KEC technology is a plug-and-play modular unit for small (population equivalent up to 10,000) and rural works. It provides a more sustainable and lower-cost alternative to liquid chemical dosing to remove phosphorus. The units are fully automated and support real-time monitoring. The benefit of the Off-Site Build is rapid, low-cost installation, simply requiring a flat surface and 3-phase power.

Our KEC technology comprises electrocoagulation cells that use electricity to generate metal coagulant ions directly from metal plates (anodes), into the effluent stream. This achieves 100% utilisation of the metal ions versus approximately 14% for dosed liquid chemical equivalents.

Cell design and technical configuration allow single-user electrode replacement (under 2 minutes), lower energy consumption (from 0.15 kWh/m³), and a patented control philosophy to prevent electrode passivation (ensuring 100% plate use without intervention). A sophisticated control system supports remote monitoring, which significantly reduces operator intervention. The practical and advanced design of the unit has received plaudits from Water Company Operators and Process Scientists trialling the technology.

KEC provides an economic and logistical solution to the growing number of disproportionately expensive smaller sites.



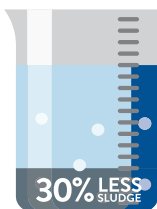
“The Kolina technology manages to react away all the sacrificial plates. It does not require the plates to be regenerated and cleaned like other systems. The solution to bridging is a game changer.”

Senior Process Scientist,
UK Water Company.

KEC vs. Traditional Chemical Coagulation



**No expert training,
No COSHH
training**



**Higher purity (3x)
and lower volume
(30% less) sludge**



**10kg KEC plate
= 5 tonne liquid
coagulant**

KEC vs. Conventional Electrocoagulation



**No-energy Patented
solution to Electrode
Passivation**



**Under 2 mins
KEC plate
change**



**No lifting equipment
required for plate
changing**

2

Proven Capability

Our KEC technology has now undergone extensive trials involving regulators, test networks, and water companies for a period of three years, including the Ofwat Water Breakthrough Challenge. EC is increasingly recognised as a favourable alternative to liquid chemical coagulation for phosphate removal and Kolina's KEC is proven as a leader in this field.

Trial results have proved that our KEC technology reduces phosphate to below 0.25 mg/l, with up to 92% removal efficiency, while residual ferric concentrations were below 2 mg/l.

The trials also demonstrated high reduction efficiencies for COD (up to 85%), TSS (up to 95%), BOD (up to 90%), and ammoniacal nitrogen (up to 70%). There is no need for pH and alkalinity correction, with sludge mass reduced by at least 30%.

During the trials, screened effluent, primary settled effluent and humus effluent were treated, with consistently high removal rates recorded for all effluent types.

KEC removes the need for liquid chemical coagulants to address the widely-anticipated chemical supply-chain challenges facing the sector.²

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Value Add

KEC offers over 25% OPEX savings over a typical liquid chemical coagulation system, with the cost of electricity and sacrificial plates proving considerably less than the cost of chemicals required for both coagulation and alkalinity correction. Reduced labour and salvage costs also contribute to this overall saving.

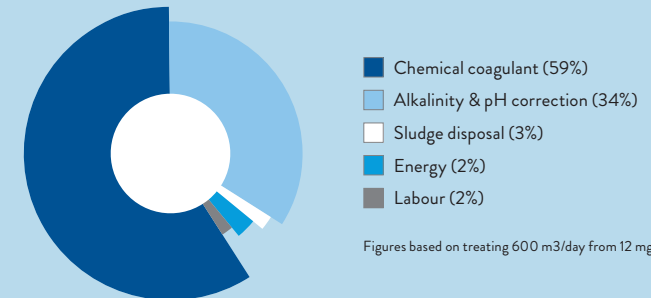
A 'neater' (no counterions like chlorine and sulphates) sludge aids recovery and repurposing into fertilisers for a circular phosphorus economy.

The cost savings of KEC are likely to increase over time as demand for liquid chemicals outpaces supply, transportation costs increase, and carbon pricing rises. This could result in OPEX and TOTEX savings of considerably more than 25%.

KEC OPEX savings are destined to grow even higher than 25% with the predicted capacity shortfall and pricing volatility of chemical coagulants.

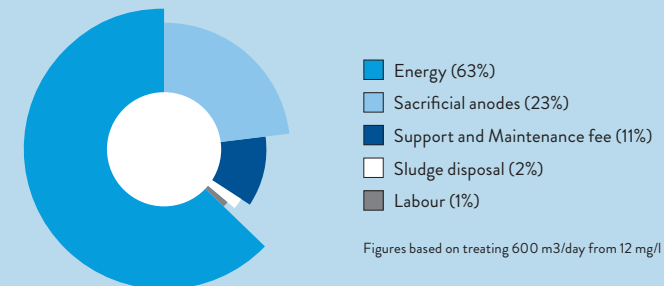
OPEX reduced by 25%

Chemical Coagulation - c£2.9m 20yr OPEX



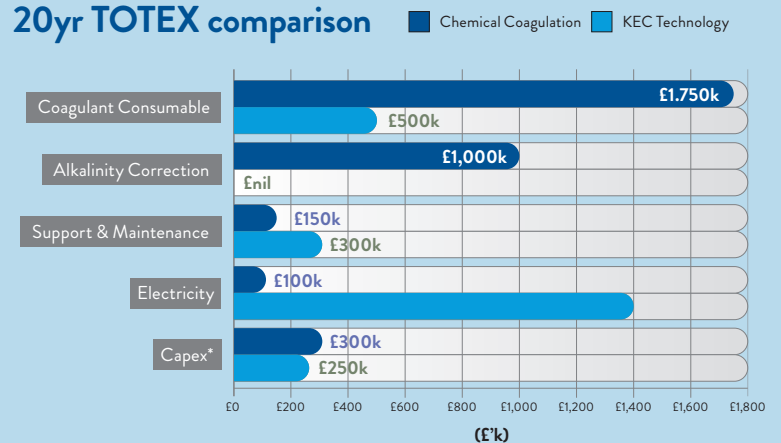
Figures based on treating 600 m3/day from 12 mg/l to 0.5 mg/l

KEC Technology - c£2.1m 20yr OPEX



Figures based on treating 600 m3/day from 12 mg/l to 0.5 mg/l

20yr TOTEX comparison



*Excludes infrastructure costs, such as access, transportation and logistics, which would be much higher for chemical dosing at small and rural wastewater sites than for KEC

4

Sustainable & Resilient

KEC's cradle-to-grave carbon footprint indicates 40% carbon savings³, increasing to 50% on decarbonising the electric grid against a liquid chemical dosing equivalent. Water UK data projects a 6-fold increase in CO₂ emissions as AMP7 solutions are implemented, doubling with alkalinity correction, making the impact and savings offered by KEC highly attractive.

A Water UK study forecasts a significant increase in consumption of Ferric Chloride (>79%), Ferric Hydroxide (>129%), and Ferric Sulphate (>200%) by 2025, leading to serious supply and pricing challenges for water companies.

The highly effective and proven KEC technology offers a sustainable alternative for the future, addressing the adverse cost, supply, deteriorating quality and emissions associated with chemical dosing.

KEC's significantly lower carbon footprint has a major role to play in both 'innovation' and 'demand-led' pathways of the Water UK Net Zero 2030 Routemap.

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Breakthrough Innovation

Our unique patented technology ("KEC") offers a more sustainable, effective, and lower cost alternative to chemical dosing for the removal of phosphorus, with lower carbon footprint and other advantages over alternative electrocoagulation providers. It also delivers high removal efficiencies for COD, TSS, BOD and ammoniacal nitrogen.

If you would like to explore what KEC can do for you, contact us via info@kolina.co.uk or speak directly with our Technology Specialists on +44 7572 536327. We'd be delighted to help.

1 Scottish Water | Water Test Network trial [Feb-21 to Sept-21] - fully funded by WTN, a partnership of various European water utilities and research institutes for innovation.

United Utilities | OFWAT trial [Aug-22 to May-24] - fully funded by OFWAT to identify alternative approaches to phosphorus removal on rural wastewater treatment works.

South West Water trial [Jun-23 to Jul-24] - a 12 month in-situ validation to prove KEC's capability to reduce phosphorus levels below 0.2mg/ltr on a chosen SWW site.

2 Narinder Sunner (Stantec Technical Director) Lets not forget the basics of chemical phosphorus removal, EWWM 2021.

3 Modelled by Minimum. Minimum Ltd are carbon accounting experts - as featured in New York Times, Carbon Pulse, Carbon Herald, Nasdaq, and Reuters - providing access to granular accurate carbon emissions data for the world's largest companies.

“If all United Utilities’ P Schemes were achieved with liquid dosing, the CO₂ emissions will increase by 49%”

Director of Wastewater Services at UU



KOLINA®