# Waterfront<sup>®</sup>



### **Product Information**

> www.wateradditives.com

### Belclene<sup>®</sup> 440 Multifunctional Deposit Control Agent for Industrial Water

Belclene 440 is a new proprietary, multifunctional, organic polymer for deposit control in industrial water treatment.

Belclene 440 provides the improved cost effectiveness of BWA Water Additives's POCA chemistry, allowing the unique combination of polymer and phosphonate functionality within the same molecule to be more fully exploited by formulation specialists.

Belclene 440 can replace existing copolymers in formulations allowing the formulator to reduce or eliminate other formulation components.

#### Features

Belclene 440 offers:

- Good calcium carbonate scale control
- Effective calcium phosphate scale control
- Exceptional phosphonate stabilization
- Effective iron oxide and particle dispersion
- Corrosion inhibition properties
- Halogen stability
- Low phosphorus content

#### Benefits

- **Reduced raw materials costs.** Cost effective replacement for two or more formulation components.
- Less time spent on making formulated products more time to focus on customers. Greater simplicity of formulations and shorter blending times.
- Fewer effluent compliance issues. Eliminate heavy metals such as zinc or molybdate or lower the phosphorus content of your formulation.
- Better control of system performance and peace of mind. Formulations can be designed for a range of scaling indices and the broad range activity of Belclene 440 enables formulations to cope with swings or upsets in cooling tower operating conditions.

• Versatility in formulation choice tailored to customer needs. Belclene 440 can be used in all-organic, phosphate and low level zinc formulations, giving scale control, dispersion and corrosion inhibition from a single product.

#### Applications

Belclene 440 is designed for use in open evaporative cooling systems. Due to its polymer/phosphonate structure and halogen stability, it displays the performance characteristics of both polymers and specialty phosphonates in one molecule. Thus, Belclene 440 performs many functions in a water treatment formulation.

Figures 1 thru 5 illustrate the numerous advanced capabilities of Belclene 440 including calcium carbonate and calcium phosphate scale inhibition, particulate and iron oxide dispersion and corrosion inhibition.

### Calcium carbonate inhibition from carboxylate and phosphonate functionalities



Figure 1: Calcium carbonate inhibition of Belclene 440 compared to other commonly used inhibitors<sup>1</sup>.

# Calcium phosphate inhibition from sulphonic acid functionality



Figure 2: Calcium phosphate inhibition of Belclene 440 compared to other commonly used scale inhibitors<sup>2</sup>.

## Efficient particle dispersion from the presence of sulphonic acid functionality



Figure 3: Kaolin dispersion efficiency of Belclene 440 compared to other commonly used scale inhibitors<sup>3</sup>.



Figure 4: Iron oxide dispersion efficiency of Belclene 440 compared to other commonly used scale inhibitors<sup>4</sup>.

#### Corrosion inhibition from phosphonate functionality



Figure 5: Corrosion protection of Belclene 440 compared to other commonly used scale inhibitors<sup>5</sup>.

#### Belclene 440 Pilot Cooling Tower Test

Belclene 440 can be used to replace several components in a formulation while maintaining optimal system performance under long half life conditions as clearly shown in the following test (using a pilot cooling tower).

Formulation 2 was used in the main cooling system of a large power station with the water chemistry outlined below. Formulation 1, containing Belclene 440, was designed to cost effectively replace 3 components from Formulation 2.

#### **Test conditions**

Formulation 1		Formulation 2	
Component	Dose	Component	Dose
	(ppm		(ppm
	solids)		solids)
Belclene	3	Belclene	2
200		200	
Belclene 440	3	РВТС	2
		AA/AMPS	3.6
		PAA	2.4
Total solids	6	Total solids	10

#### Water chemistry:

Component	ppm
Calcium	332 (as CaCO <sub>3</sub> )
Magnesium	67 (as CaCO <sub>3</sub> )
Bicarbonate	358 (as CaCO <sub>3</sub> )
Total Alkalinity	375 (as CaCO <sub>3</sub> )
Sulphate	160
Chloride	344
Sodium	211
TDS	1322
рH	8.8
ĹSI	2.12
RSI	4.56
Larson -Skold index	1.67

#### **Test Parameters:**

Half life	61 hours
Heat exchangers	Stainless Steel
BTU's	10,000 BTU/hr/ft2
Time	14 days
Bulk Temp	40°C/104°F
Flow rate	1 m s <sup>-1</sup> /3ft s <sup>-1</sup>

#### Test Results

Both formulations gave good performance but heat exchangers exposed to Formulation 1 were clean and those treated with Formulation 2 experienced deposit build up, as demonstrated in the following tables.

#### Fouling rates:

Fouling Rate - average from two heat exchangers $(mg/cm^2/day)$		
Formulation 1	0.0063	
Formulation 2	0.0296	

(mg/cm²/day)
Good
Moderate
Poor
Unacceptable

**Top:** Clean heat exchangers after 14 days test with Formulation 1 (3 ppm Belclene 440 / 3 ppm Belclene 200).



**Bottom:** Heat exchangers with deposit build up after 14 days test with Formulation 2 (2 ppm Belclene 200 / 2 ppm PBTC / 3.6 ppm AA/AMPS and 2.4 ppm PAA).

This pilot cooling tower test clearly demonstrates the benefit of the carboxylate and phosphonate functionalities of Belclene 440. Belclene 440 provides effective calcium carbonate control as well as overall system stability control.

As an added benefit the total P contribution from formula 1 has 0.09 mg/L, whereas the conventional formula (2) had 0.23 mg/L P. The difference of 0.14 mg/L represents a decrease of 61 %. So in addition to providing a cleaner heat exchange surface Belclene 440 also lowered the environmental impact of the treatment program.

#### Further benefits of Belclene 440

 Low phosphorus content compared to phosphonates

	% <b>"P"</b>	% "PO <sub>4</sub> <sup>3-</sup> "
	as product	as product
HEDP	18	55
PBTC	6	18
Belclene 440	1.5	4.7

 5% Belclene 440 as product in a formulation dosed at 100 ppm adds only 0.24 ppm as PO<sub>4</sub><sup>3-</sup>

#### **Typical Physical Properties**

Appearance	Clear, pale yellow liquid
Solids content	40% (w/w)
Specific gravity (20/20)	1.20
pH (neat at 20°C)	<2
Viscosity at 25°C	20 mm <sup>2</sup> /s

#### **Regulatory Registrations**

Belclene 440 is listed on the following inventories: Australia AICS - in progress Canada DSL Europe - exempt USA TSCA

#### Footnote:

Test conditions for Figures 1 to 5.

Figure	1	2	3	4	5
Ca2+ as CaCO3 (ppm)	375	250	200	100	150
CO32- as CaCO3 (ppm)	85	-	-	-	
HCO <sup>3</sup> as CaCO <sub>3</sub> (ppm)	220	-	100	60	
Mg <sup>2+</sup> as CaCO <sub>3</sub> (ppm)	185	-	-	-	
PO <sub>4</sub> <sup>3-</sup> (ppm)	-	10	-	-	-
Fe <sup>3+</sup> (ppm)	-	-	-	75	
TA as CaCO3 (ppm)	-	-	-	-	350
TH as CaCO3 (ppm)		-	-	-	225
Cl <sup>-</sup> (ppm)	-	-	-	-	200
SO4 <sup>2-</sup> (ppm)	-	-	-	-	200
pH	8.2	8.5	8	8.5	8.1
Temp	70°C	70°C	ambient	ambient	-
Time	30 mins	24 hrs	4 hrs	30 mins	-
LSI	2.4	-	-	-	0.9
Dosage	as solids	as solids	10 ppm solids	10 ppm solids	as solids
Other		-	0.1%Kaolin	-	

BWA Water Additives Europe & Middle East Region 2 Brightgate Way, Cobra Court Stretford, Manchester M32 0TB United Kingdom Telephone + 44 161 864 6699 Fax + 44 161 864 6666 BWA Water Additives Americas Region 1979 Lakeside Parkway, Suite 925 Tucker, GA 30084 USA Telephone + 1 678 802 3050 Or 800 600 4523 BWA Water Additives Asia Pacific Region Telok Blangah East Post Office PO Box 129 Singapore 910901 Telephone + 65 9758 0554 Fax + 65 6234 3606

#### Visit our website at: www.wateradditives.com

The information contained in this product sheet is based on data available to BWA Water Additives and is thought to be correct. Since BWA, has no control over the use of this information by others, BWA does not guarantee the same results described herein will be obtained, and makes no warranty of merchantability or fitness for a particular purpose or any express or implied warranty. This information is intended for use by technically trained personnel at their discretion and risk. BWA Water Additives UK Limited is a private limited company registered in England and Wales at 2 Brightgate Way, Manchester M32 0TB, Registered No. 5657343



Logistics Classification

Classification	Hazardous for transportation Irritant for supply
Packaging	Net weight 250 kg (551lb) HDPE drum

Details on safety and handling are available in the material safety data sheet on this product.

#### Conclusion

Belclene 440 is a true multifunctional water additive. The substitution of an existing homo- or co-polymer in a formulation with Belclene 440 can reduce or eliminate the number of other components while maintaining system performance. The results for the formulator are:

- Reduced raw materials costs
- Less effort expended on making formulated products
- More time to focus on customers
- Fewer effluent compliance issues
- Versatility of formulation choice tailored to customer needs - more choice from just one additive
- Better system control and peace of mind

#### Patents

BWA Water Additives (BWA) owns or is the licensee of patents and patent applications, which may cover the products and/or uses described in this brochure.

The following are registered trademarks of BWA Belclene, Drop and Swirl logo.

<sup>®</sup> Registered US Patent and Trademark Office.

© 2008 BWA, All rights reserved.

V0408