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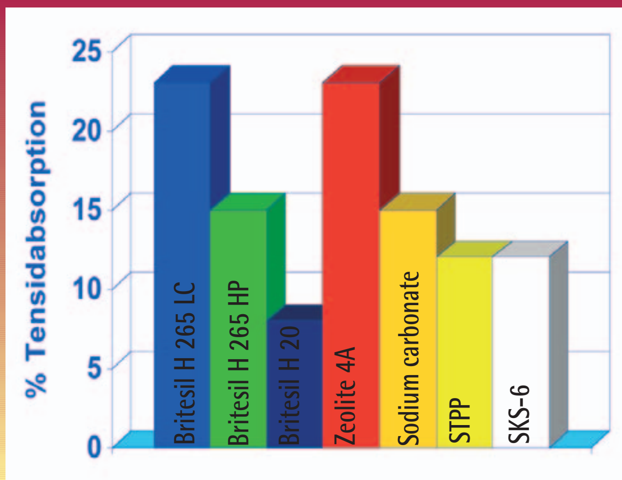
Properties of the Britesil® range of silicates:

	Britesil® H 20	Britesil® H 265 HP	Britesil® H 265 LC
Molar ratio SiO_2: Na_2O	2.0	2.65	2.65
Water, %	16 – 20	16 - 20	16 - 20
Bulk density, g/l	750 – 900	675 - 775	450 - 550
LCC, Nonionic surfactant, %	5 – 10	10 - 15	22 - 26

*LCC: Liquid carrying capacity

Britesil H 20 and Britesil H 265 HP can also be delivered as powders. The trade names are Britesil® C 20 and Britesil® C 265-P



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E. Olsson:

New Developments in Detergent Formulations –

New Silicate Builder

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New Developments in Detergent Formulations New Silicate Builder

Keywords: soluble silicates, detergents, builder

Introduction

The trend in the detergent market towards new product forms and new improved formulations is a continuous process.
Ecological and economical demands of the products in the detergent market as well as changes in the wash conditions and consumer behavior require new developments of detergent raw materials that correspond to the high demands of modern detergent products.
The development of new temperature-sensitive and colored textiles requires washing at low temperatures. The new modern washing machines display a wide range of different programs including programs with shorter wash cycles, fewer rinse cycles and lower water consumption. The consumers, not wanting to spend too much time on washing, require convenience and high performance at low cost.
New detergent formulations and product forms have to be adapted to these developments, especially with respect to low wash temperatures and lower amount of water per wash.

Detergent Formulation Trends in Europe

As in the past, the new detergent formulations to a major part (>80%) also consist of the following basic detergent ingredients:

- Builders: 30 - 60%
- Surfactants: 10 - 25%
- Bleach agents 5 - 30%

The builder system is an essential part of a laundry detergent. It creates an environment in which the other ingredients like surfactants, bleach agents and enzymes can work at their optimum performance.
The choice of the appropriate builder system is therefore very important. In addition to the builder properties, the process properties and the compatibility with other raw materials are of high importance for achieving the most optimal efficiency of the finished detergent product.

The Development of Builder Systems in Europe

The following overview shows the most common builder systems used in European detergent formulations:

- Phosphate (STPP)
- Zeolithe
- Soluble builder systems containing:
  – Carbonate
  – Silicate
  – Citrate
  – Polymers (Polycarboxylate)
  – Phosphonate

Although phosphate is an excellent builder, it has some disadvantages. One being the negative impact to the environment, which has lead to bans or restrictions in various parts around the world. Phosphate causes eutrophication, which means that it works as a nutrient and hence can cause excessive growth of algae. In countries where phosphates are still used, detergent manufacturers are now looking for alternatives.
Zeolites, which during the last decades has been used as a phosphate replacement, is now being reduced or completely phased out because of its insolubility in water.
As the wash temperature and the water consumption is constantly going down and the wash cycles are getting shorter, there is a trend towards soluble builder systems without phosphates and zeolites. These builder systems usually

consist of soluble silicate, carbonate and a polymer, with the possible addition of phosphonate and/or citrate.
Renowned detergent producers already offer such products on the European market. Most of these products contain soluble silicates as one of the builder components.

Properties of Soluble Silicates

The soluble silicates, to which the spray-dried and granulated silicates (Britesil®) belong, have, thanks to their multifunctional properties, found a wide spread use in modern detergents:

- **Builder properties**
  - Calcium and magnesium sequestration
  - Buffering and pH control during the washing process
  - Enhance the performance of the surfactant system by lowering the interfacial tension
  - Aid in preventing soil redeposition of particulate soil on the textiles
  - Carrier of liquid ingredients
- Stabilizes the bleach system
- Corrosion inhibitor

The unique product properties of soluble silicates are demonstrated by the following tests.

Surfactant Sorption of Builders

The new soluble builder Britesil H 265 LC shows the same high sorption capacity as the insoluble zeolite 4A. The sorption test is done with a commonly used nonionic surfactant based on of C12-15 fatty alcohol + 7EO **(Fig. 1)**.

Storage Stability of Percarbonate

Compared to zeolite 4A, the soluble silicates significantly improve the storage stability of percarbonate. The combination of amorphous silicate and zeolite 4A shows a better storage stability of percarbonate than the combination of crystalline silicate (SKS-6) and zeolite 4A.

Properties of the Britesil® range of silicates:

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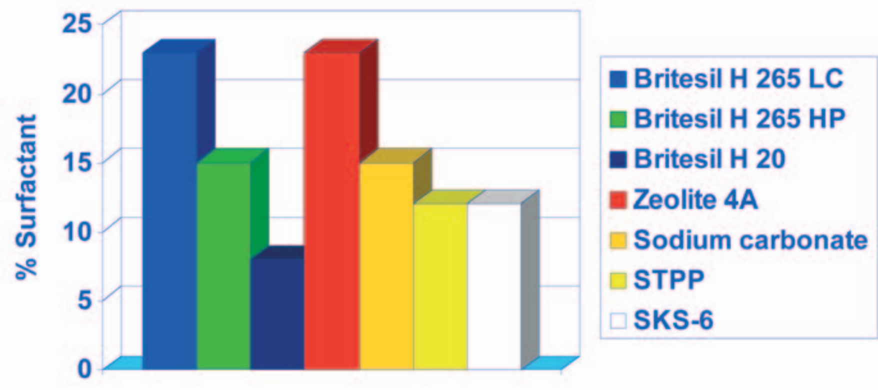

Fig. 1 Absorption test of nonionic surfactant

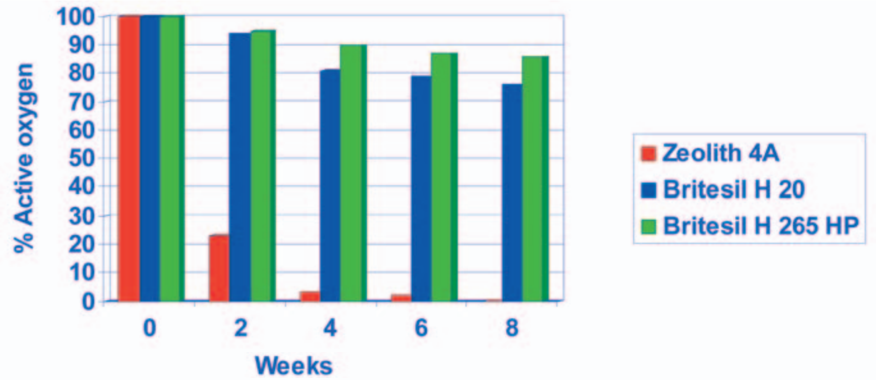

Fig. 2 Storage stability test with unstabilized percarbonate

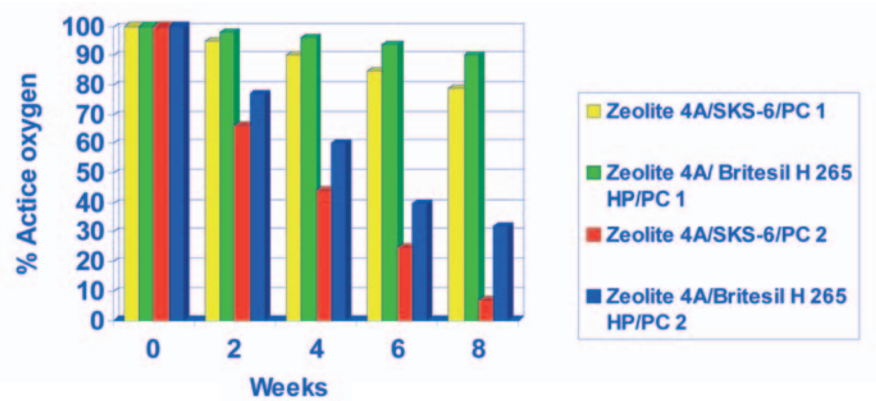

Fig. 3 Storage stability test with stabilized percarbonate

Equipment:	Miele washing machine	**Load:**	4,5 kg
Method:	DIN 44 983	**Dosage:**	70 g/wash
Swatches:	Empa 101: Soot, olive oil WFK AS9: Pigment, oil, Milk WFK PC9: Pigment, oil Empa 114: Red wine Cotton and terry towel (ash conent)	**Formulation:** - Anionic surfactant (LAS) - Nonionic surfactant - Soap - Builder - Perborate Monohydr. - TAED	g/wash 9 7 2 34 14 4
Temperature:	60°C	**Builders:**	• Zeolite 4A • Britesil H20 • Britesil H265 HP • Zeolite/ • Britesil H 265 HP: 75/25
Water hardness:	20°dH, Ca:Mg = 3:1		
Wash cycles:	Primary cleaning: 1 cycle Secondary cleaning: 10 cycles		

Table 1 Results of Britesil products in comparison to zeolite 4A: Test conditions

1. Storage stability test with unstabilized percarbonate (Fig. 2)
Test conditions: closed boxes, 40°C, builder: percarbonate 2:1

2. Storage stability test with stabilized percarbonate (Fig. 3)
Test conditions: open vials, 30°C, 80% RH., percarbonate type 1 (Pc 1), percarbonate type 2 (PC 2); zeolite 4A/siliccate/ percarbonate: 30% / 30% / 40%.

Results of Detergency Tests

1. Results of Britesil products in comparison to zeolite 4A:
Numerous wash tests have been carried out with soluble silicates in base formulations. The wash results compared to zeolite 4A based detergent are shown in **Table 1**, **Fig. 4** and **Fig. 5.**

2. Results of Britesil H 265 LC compared to Britesil H 265 HP
Table 2, **Fig. 6** and **Fig. 7** shows the results.

3. Results of Britesil H 265 HP compared ot Sodium Carbonate
The silicate based builder system is, with respect to ash content on textiles, more effective compared to the sodium car-

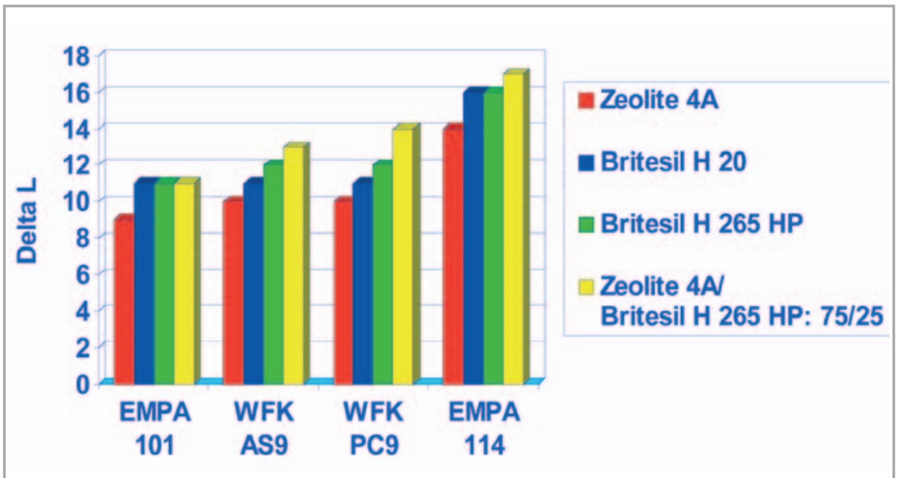

Fig. 4 Primary cleaning

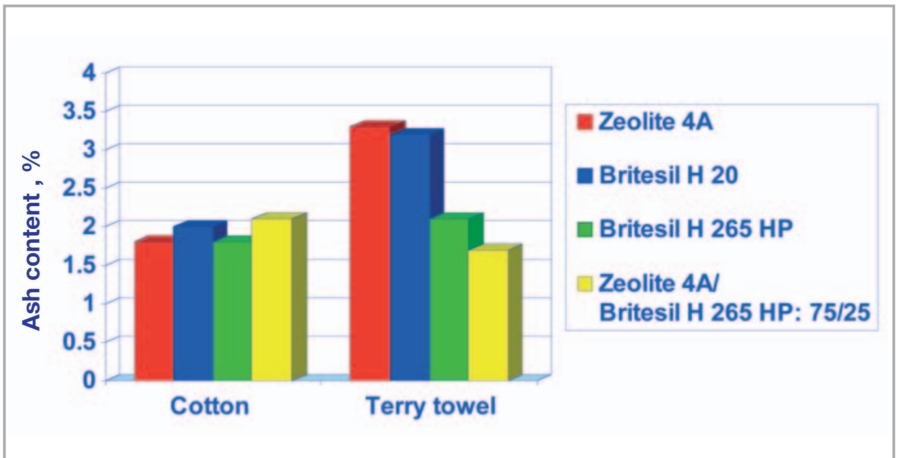

Fig. 5 Secondary cleaning (ash content)

Temperature:	40°C	**Formulation and dosage:**		
Water hardness:	20°dH, Ca/Mg = 3:1	Ingredient:	Britesil H 265 HP	Britesil H 265 LC
Wash load:	3,5 kg white terry towel	LAS	9	9
Primary cleaning:	∅ 10 wash cycles	Soap	2	2
Secondary cleaning:	Ash content after 10 wash cycles	Perborate Monohydrate	14	14
Test swatches:		TAED	4	4
– EMPA 101:	Cotton, soot, olive oil	Britesil H 265 HP	34	–
– WFK AS 9:	Cotton, pigment, oil, milk	Britesil H 265 LC	–	34
– WFK PC 9:	Polyester/cotton, pigment, oil	Lutensol AO7	6	6
– EMPA 114:	Cotton, red wine	Sokalan CP 53	3	
		Dosage, g/wash	72	72

Table 2 Results of Britesil H265 LC compared to Britesil H 265 HP: Test conditions

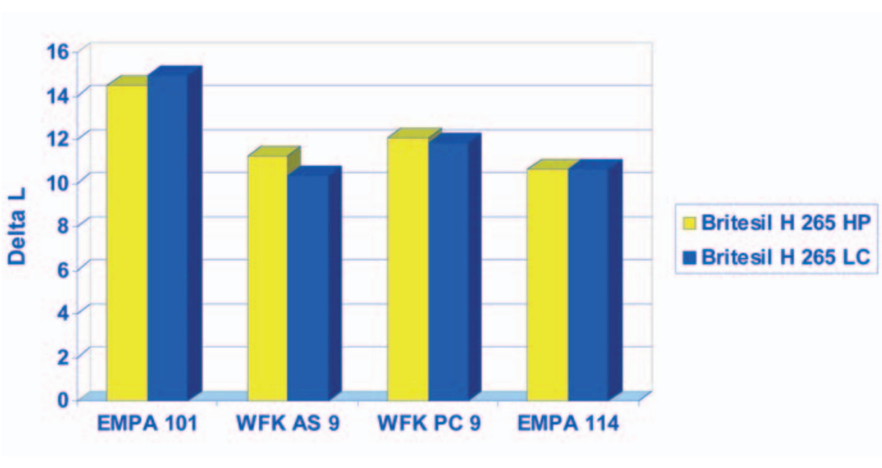

Fig. 6 Primary cleaning

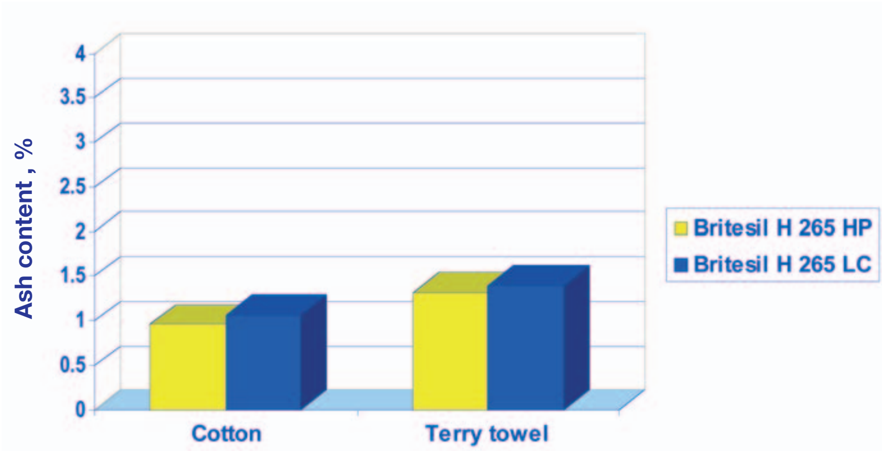

Fig. 7 Secondary cleaning (ash content)

bonate system. Because of the multifunctional properties, the soluble silicates show advantages in processing and application. (**Table 3**, **Fig. 8** and **Fig. 9**).

Summary of the Detergency Results

The results of the wash tests have shown that the Britesil® based formulations, compared to those based on zeolite or sodium carbonate, are at least equal or clearly superior with respect to:

- Detergency (primary cleaning)
- Ash content (secondary cleaning)

In commercial use major detergent producers have confirmed the substitution of zeolite Britesil® in relation 1:1.
The Britesil® products contribute to the improvement of the detergency and to lower ash content on textiles compared to the same concentration of zeolite or sodium carbonate.
The Britesil products are recognized as multifunctional detergent builders. Their application functions like easy processing, high absorption of surfactants, stabilization of bleach and enzymes, excellent pH buffering and high washing ef-

		Formulation and dosage:		
Equipment:	Miele washing machine	Ingredient:	Britesil H 265 HP	Sodium carbonate
Test method:	DIN 44983	LAS	9	9
Temperature:	30°C	Lutensol AO7	7	7
Water hardness:	20°dH, Ca/Mg = 3:1	Soap	2	2
Wash load:	4,5 kg white terry towel	Perborate Monohydrate	14	14
Primary cleaning:	1 Wash cycle	TAED	4	4
Secondary cleaning:	Ash content after 10 wash cycles	Britesil H 265 HP	24	4
Test swatches:		Sodium carbonate	10	30
– EMPA 101:	Cotton, soot olive oil	Sokalan CP 53	5	5
– WFK AS 9:	Cotton, pigment, oil, milk			
– WFK PC 9:	Polyester/cotton, pigment, oil			
– EMPA 114:	Cotton, red wine	Dosage, g/wash	75	75
– Cotton and terry towel (ash content)				

Table 3 Results of Britesil H 265 HP compared to Sodium Carbonate: Test conditions

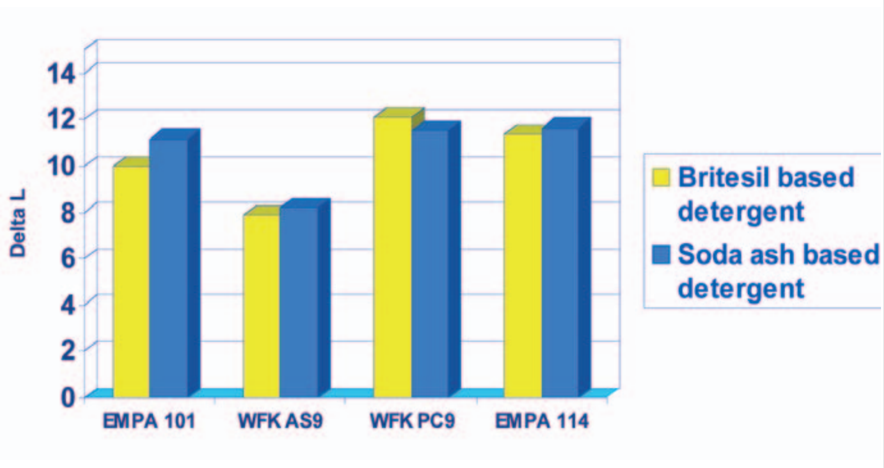

Fig. 8 Primary cleaning

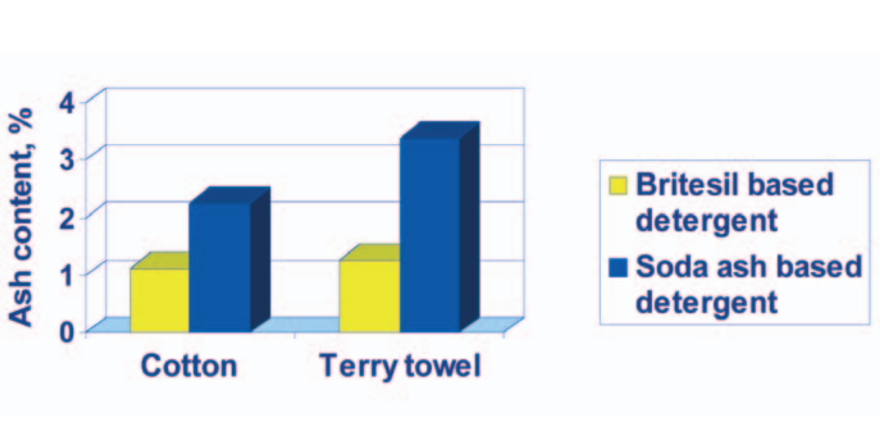

Fig. 9 Seconcary cleaning (ash content)

ficiency at lower temperature and water content are significantly improved compared to traditional builders.

Summary

The soluble Britesil®-silicates can replace both phosphate and especially zeolites in detergent formulations. In addition to the builder function, the Britesil®-silicates stabilize the bleaching system and enhance the performance of the surfactants. Britesil H 265 HP and especially Britesil H 265 LC possess a high absorption capacity of liquid ingredients, for example nonionic surfactants and can be used in both detergent powders and tablets.
These silicates are easy to process in the manufacture of detergent powders and tablets. Their efficiency in the final products gives an essential contribution to the cost reduction of detergents.

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