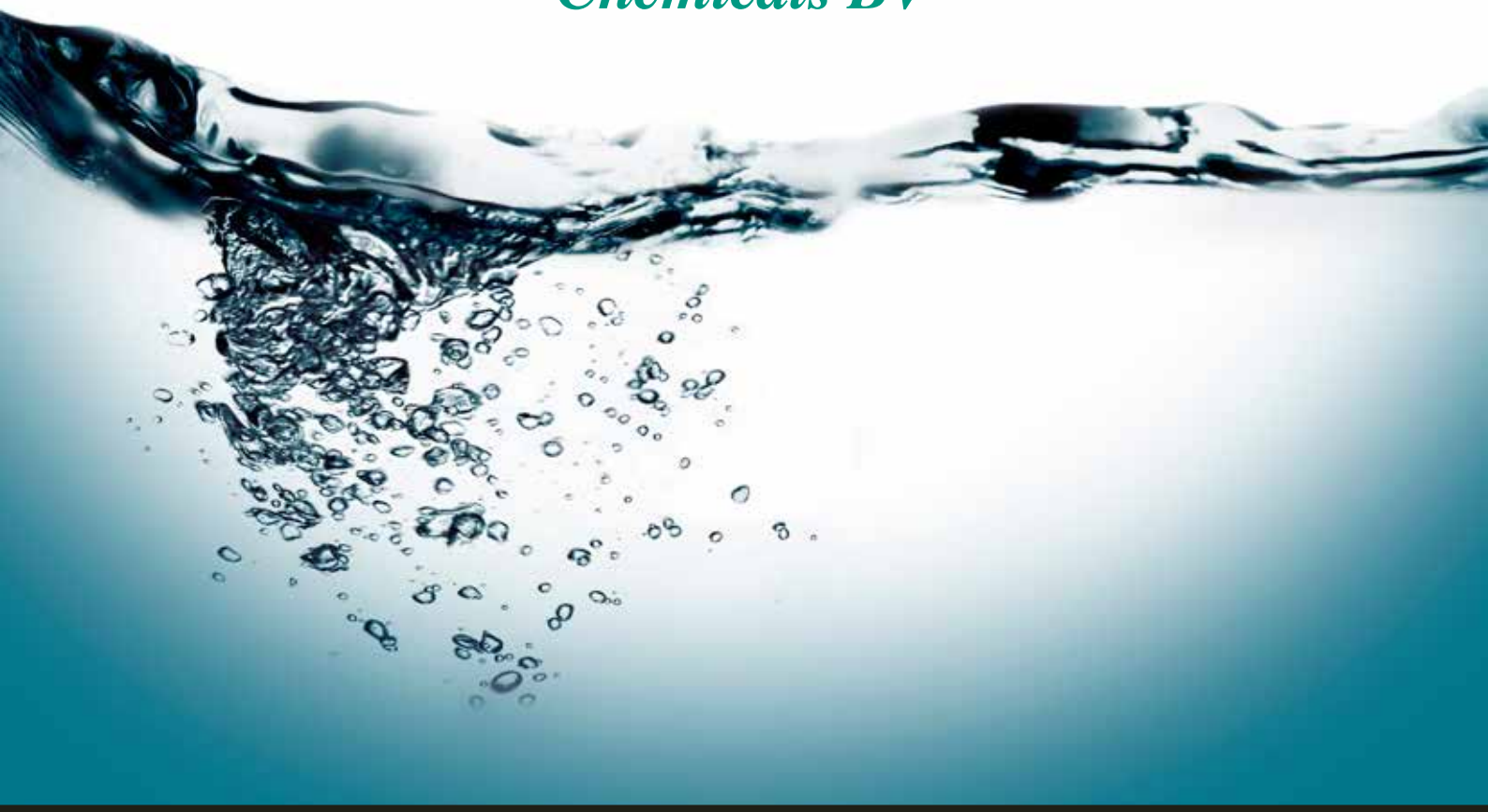
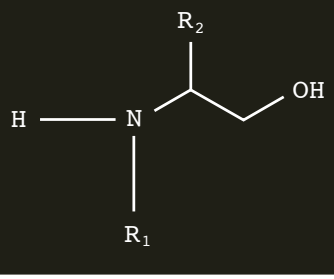
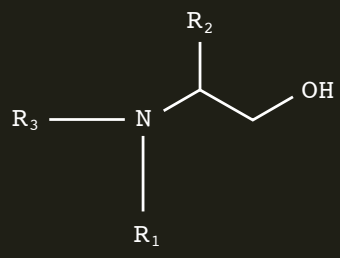
ADDAPT
Chemicals BV



for tomorrow's
Technology





CODIS™ 95 & CODIS™ BIO

Neutralizing Agents

for tomorrow's
World

Contents

1. Introduction

Amines are used in emulsion polymerisation to provide mechanical stability of resultant dispersions and also in coatings manufacture to assist with pigment dispersion, grind stability if dispersing pigments into polymer dispersion and also pH buffering of dispersion coatings.

Ammonia is the most commonly used amine, being low cost, but is highly odorous and has high volatility resulting in pH instability. To overcome these disadvantages formulators have looked at successfully incorporating various Alkanol-amines. In addition to lower volatility and lower odour, these Alkanol-amines also allow superior corrosion resistance, VOC reduction in formulation, excellent pH buffering and very good pigment dispersion properties.

After application of the wet coating, the pH-adjusting agent MUST either, at least partially, evaporate from the film in order to promote the coalescense of the resin binder and to avoid poor early water resistance or become completely inert in the resulting coating film.

ADDAPT® Chemicals BV now markets CODIS™ 95, a proprietary blend of Alkanol-amines with an active content of 90%. This is an almost colourless liquid with a low viscosity, that remains liquid at temperatures below -10°C and withstands >5 freeze/thaw cycles at -15°C. It is an excellent pH-buffer with emulsifying properties.

Additionally ADDAPT® Chemicals BV markets CODIS™ BIO, a multifunctional neutralizing agent for Ecolabel certified paints. It enhances compatibility with pigments, wetting and flash rust inhibition. It is based on renewable components, VOC/SVOC free and without hazardous labelling.

2. Typical properties CODIS™ 95 & CODIS™ BIO

ADDAPT® CODIS™ 95 and CODIS™ BIO are proprietary blends containing Alkanol amines in water. All constituents are EINECS, TSCA, ENCS, AICS, DSL, ECL and PICCS registered.

	CODIS™ 95	CODIS™ BIO
Appearance	Clear, colourless liquid	Clear, colourless liquid
Colour (max.)	15 Hazen	25 Hazen
Active content	90%	< 55%
Water content	9.5 - 10.5%	45.5 - 47.5%
Freezing point	< -10°C	< -10°C
Freeze/Thaw stability	> 5 cycles @ -15°C	> 5 cycles @ -15°C
pH (1% aqueous solution, 20 °C)	< 11.3	< 10.5
Density at 20 °C	1.05 - 1.10 g/cm^3	1.13 - 1.15 g/cm^3

3. Performance benefits CODIS™ 95 & CODIS™ BIO

CODIS™ 95	CODIS™ BIO
• Very good, cost efficient pH-buffer	• Very efficient neutralizing agent
• Cost efficient Co-dispersant	• Improves tinting strength
• Enhances wet-scrub resistance	• Improves storage stability
• Excellent early water resistance	• Improves open-time
• In-can corrosion protection (flash rust)	• In-can corrosion protection (flash rust)
• Low odour	• No odour
• Low VOC - medium volatility	• No VOC/SVOC
• Non-yellowing	• Non-yellowing
• Effective CO_2 scavenger	• > 75% biodegradable
• Very good emulsifying properties	• Aerobic and anaerobic biodegradable
• Allows emulsification of > 17.5% water in solvent based systems	• LABEL FREE!

4. FDA-status

CODIS™ 95 and CODIS™ BIO are in compliance with FDA regulations for direct and indirect food contact: Section 175.105, Section 176.170 and 176.180 and Section 175.300. Additional information about other clearances is available on request.

5. Performance – Water based systems

5.1 Amine comparison – primary/secondary/tertiary

Amine	Composition	Comments
CODIS™ 95	Blend of Alkanol-amines in water	Non-secondary Amines
CODIS™ BIO	Proprietary blend	Tertiary Amines
AMP 95	2-amino-2-methyl-1-propanol	Primary amine - < 7% sec. amine
ADVANTEX	2-(n-Butylamino)ethanol	Secondary Amine
Ammonia	NH_3	Primary Amine

5.2 Yellowing

To test for yellowing CODIS™ 95 and CODIS™ BIO were put in a beaker glass and exposed to air at room temperature. No change in colour was observed over a period of 2 month.
Further CODIS™ 95 and CODIS™ BIO were added at a level of 0.5% to neat Styrene/Acrylic, Acrylic, VA/Acrylic and VA/VEOVA emulsions. Samples were stored at 50°C for 1 month. Again no discernible yellowing was observed.

5.3 Cobalt leaching

The leaching of Cobalt from tungsten-carbide tools can shorten tool life and the presence of Cobalt in the used fluid can lead to dermatitis and/or inhalation problems for exposed workers as well as cause problems in waste water disposal. CODIS™ 95 exhibits minimal Cobalt leaching.

5.4 Nitrosamine formation

Nitrosamines and especially ***N-Nitrosamines*** are considered to be very ***carcinogenic***.

Secondary (Alkanol)-amines are the most potent to form N-Nitrosamines. These N-Nitrosamines are readily formed by the reaction of secondary (Alkanol)-amines with Nitrites or Nitrogen Oxides.

Germany instituted regulations in the 1990's that prohibited the use of secondary amines in metalworking fluids. Both primary and tertiary amines can be used in metalworking formulations and metal primers with little risk of Nitrosamine build-up.

5.5 Wet Adhesion – Early water resistance

Since the introduction of AMP 95, other Alkanol-amines have entered the market place; all claiming to have performance benefits. These Alkanol-amines, along with ammonia, were assessed for film resistance properties in Revacryl DP5530 (ex-Synthomer).

5.5.1 Amines evaluated

Amine	Composition	Comments
CODIS™ 95	Blend of Alkanol-amines in water	Low odour, medium volatility
CODIS™ BIO	Proprietary formulation in water	No odour, non volatile
AMP 95	2-amino-2-methyl-1-propanol	Low odour, slow volatility
ADVANTEX	2-(n-Butylamino)ethanol	Slow odour, very slow volatility
Ammonia	NH_3	Strong odour, fast volatility

5.5.2 Experimental

Each amine was added at 0.2% addition level to neat Revacryl DP5530 (ex-Synthomer). Films were then applied at 100 microns wet film thickness onto degreased cold rolled steel panels. Panels were dried for 15 minutes at 60°C then 16 hours at room temperature. Panels were then soaked in tap water for 48 hours. On removal from water, panels were patted dry and a Cross Hatch Adhesive Tape Pull-Off test performed.

5.5.3 Results

Amine	**Wet adhesion** (% film removed)
CODIS™ 95	0
AMP 95	100
ADVANTEX	60
Ammonia	0

5.5.4 Discussion

It is evident that amine choice has a major effect on wet adhesion of the polymer film onto cold rolled steel in this instance. Excellent results were obtained with Ammonia and CODIS™ 95. It is believed this is due to volatility of each amine under test, with lower volatility amines still being present in the film and imparting water sensitivity, in combination with a function of neutralisation of carboxylic groups present in the polymer.

6. Performance – Solvent based systems

The ability to incorporate high levels of water in solvent based Alkyd paints is shown in the following section where the performance of CODIS™ 95 is compared with a well known competitive product.

6.1 Solvent based ALKYD paint – Test formulation

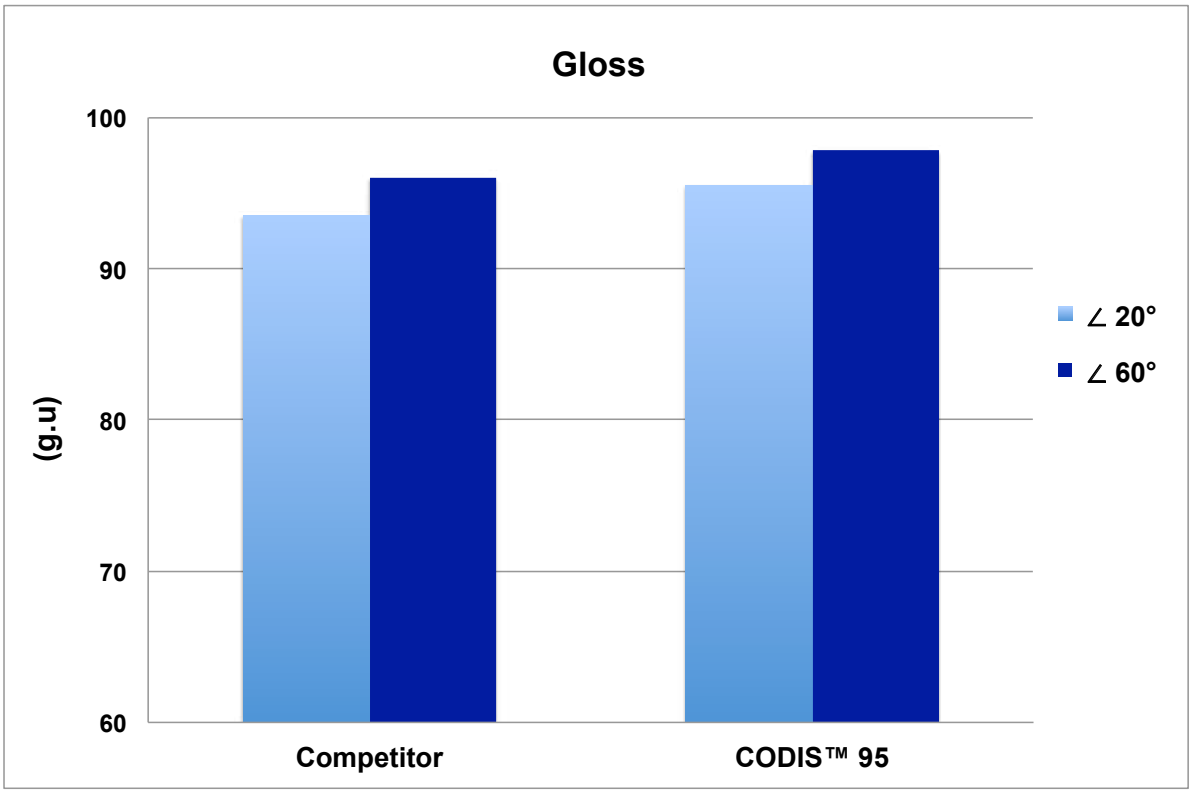
Component	Competitor	CODIS™ 95
Polikyd AS 652/75D*	37.10	37.10
Bentone SD-1	0.10	0.10
Disperbyk 108	0.45	0.45
Titanium Dioxide R-706	28.90	28.90
Calcium Octoate 5%	1.30	1.30
Cobalt Octoate 2%	1.05	1.05
Zirconium Octoate 6%	1.35	1.35
White Spirits (Solvent D40)	8.80	8.35
Xylene	3.05	2.05
Anti-Skinning agent (MEKO)	0.25	0.25
Competitor	0.15	---
CODIS™ 95	---	0.15
Water	17.50	18.95
Total	**100.00**	**100.00**

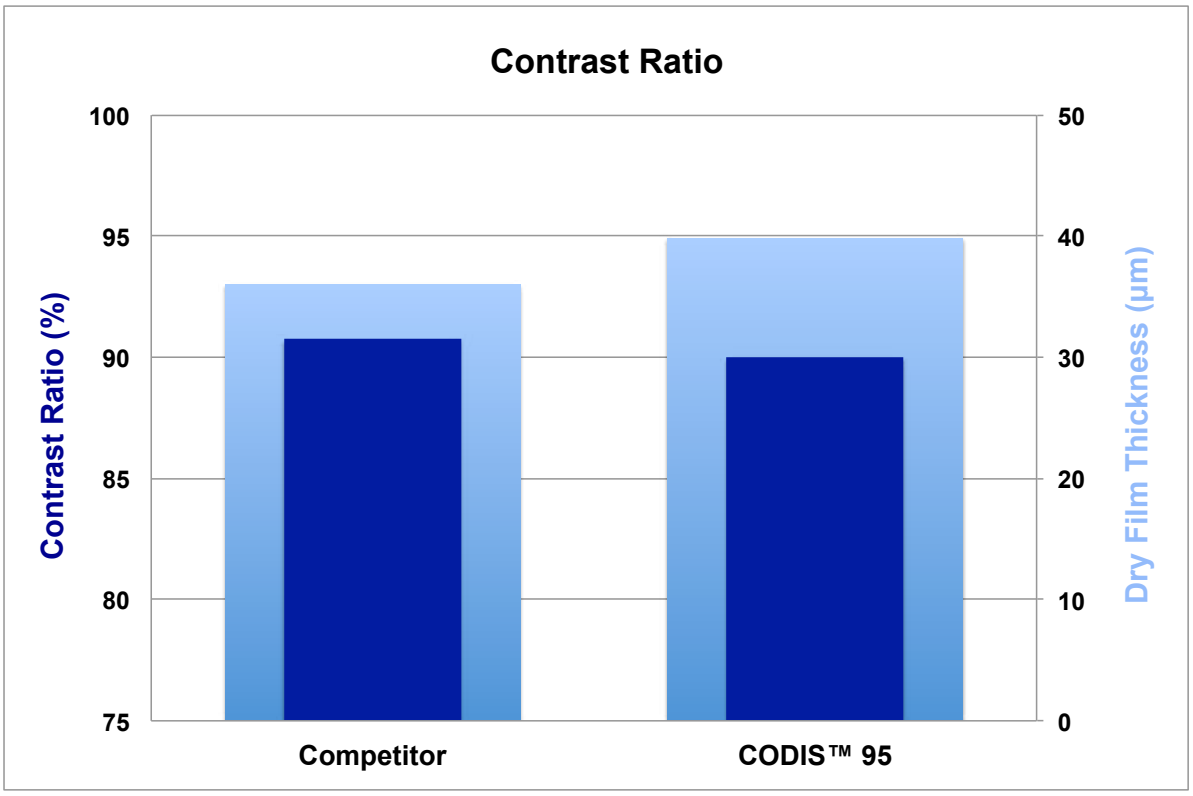
** Resiquimica*

Characteristics	Competitor	CODIS™ 95
Initial Flow time at 23ºC (s)		
Stormer at 23ºC (KU)	**82.8**	**80.0**
Solvent for viscosity adjustment to 80 KU (%)	**0.4**	**---**
Viscosities can		
Stormer at 23ºC (KU)	**80.0**	**80.0**
Solids content (%)	**58.4**	**57.8**
Density at 23ºC	**1.210**	**1.208**
Solvent for viscosity adjustment to DIN4 70s (%)	**3.0**	**3.3**
Viscosities for application by brush		
DIN4 23°C (s)	**74**	**72**
Theoretical VOC (g/l)	**299**	**299**

6.2 Gloss development and contrast ratio

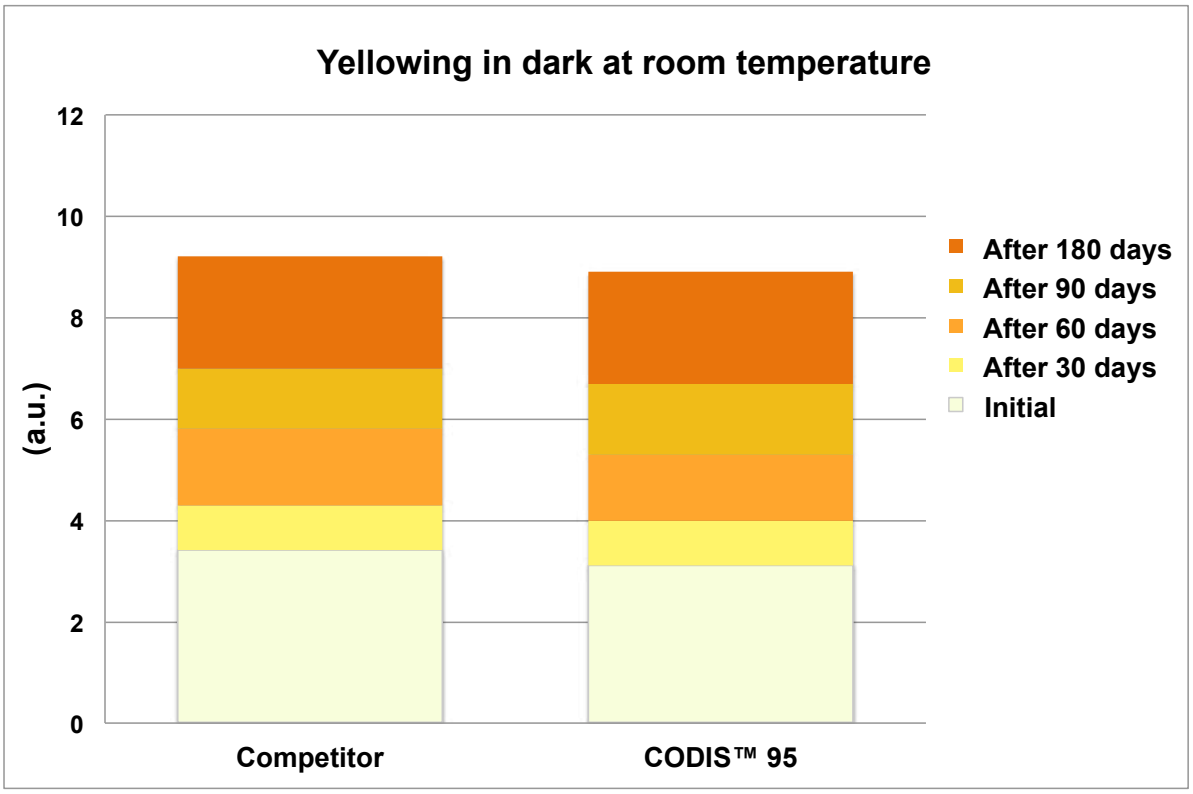
Incorporation of this amount of water using CODIS™ 95 versus this well known competitor results in higher gloss levels both at ∠ 20° and ∠ 60° whereas the contrast ratio is higher at somewhat lower film thickness.





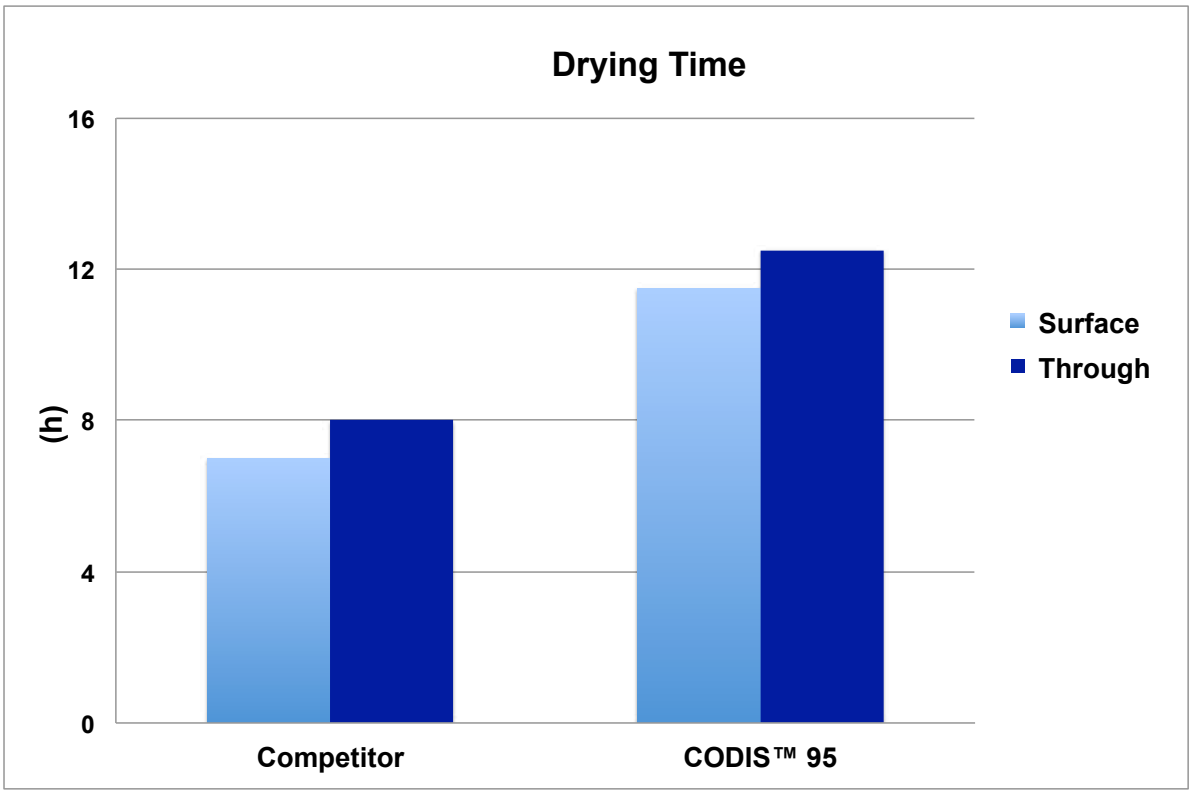
6.3 Yellowing in the dark

Upon aging in the dark CODIS™ 95 is less susceptible to yellowing compared to the competitor (see graph below). A similar trend is observed at 60°C.



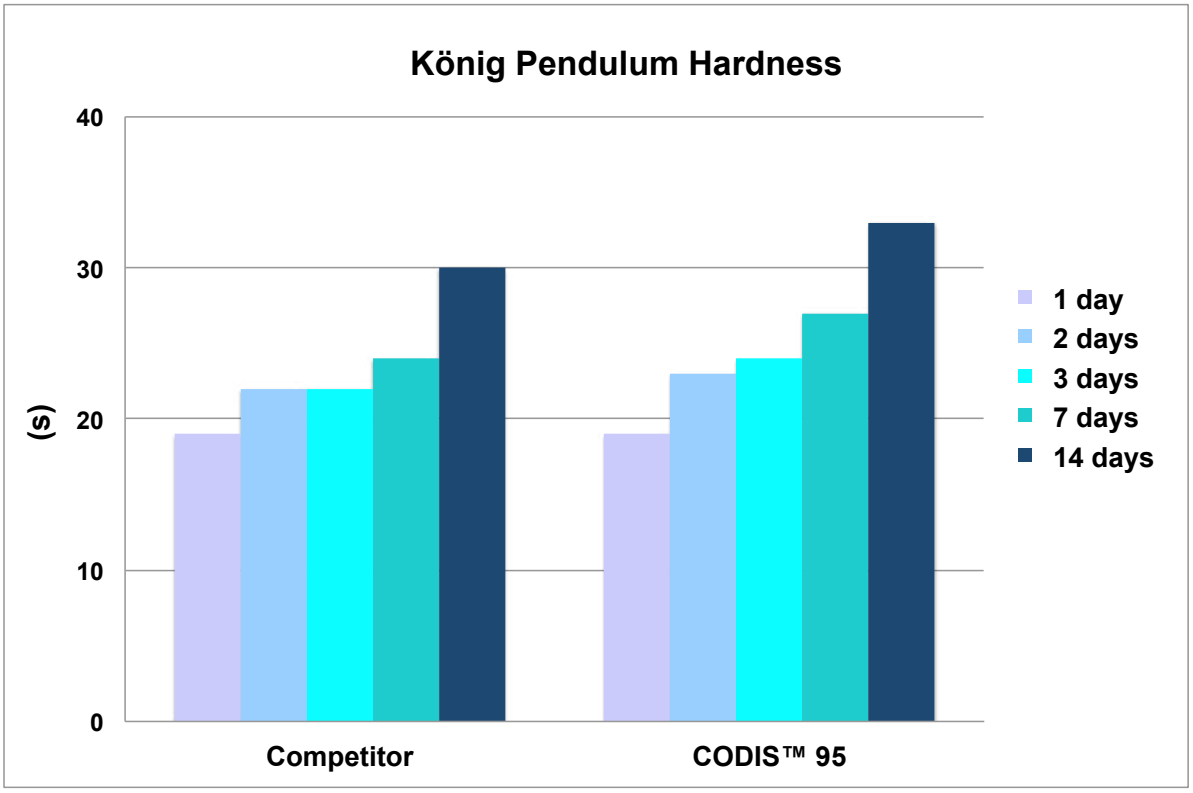
A prolonged drying time was observed for CODIS™ 95 which is mainly due to the slower evaporation rate and also inherent to a non-optimised formulation.

6.4 Drying time



6.5 König Pendulum Hardness

Remarkably however, the development of the König Pendulum Hardness was positively affected by CODIS™ 95 in comparison with the competitive product.



7. Health, Environmental and Safety issues

For labelling of CODIS™ 95 and CODIS™ BIO some physical data were compared with Aminomethyl Propanol (95% in water).

	CODIS™ 95	CODIS™ BIO	AMP 95
Renewable content	> 40%	> 75%	X
Free of Environmental Hazard Label	√	√	H412
Ready Biodegradable	√	√	√
Free of Physical Hazard Label	√	√	H227
Free of Human Hazard Label*	H314, H319, H335	√	H303, H315, H319
Hazardous pictogram - GHS	GHS05, GHS07	√	GHS07
VOC-free	X	√	X
SVOC-free	√	√	√

H227	Combustible liquid
H303	Maybe harmful if swallowed
H314	Causes severe skin burns and eye damage
H315	Causes skin irritation
H319	Causes serious eye damage
H335	May cause respiratory irritation

* CODIS™ 95: Label based on the sum of ingredients. CODIS™ 95 has similar pH compared to AMP 95 (1% in water - ***literature***): < 11.3 and a somewhat lower pKa: 9.54 vs 10.02

Environmental information

Both CODIS™ 95 and CODIS™ BIO are expected to partition (preferentially locate) in water when released to the environment. Because of their water solubility and reactivity with other compounds, CODIS™ 95 and CODIS™ BIO biodegrade rapidly and are not likely to bioaccumulate in the aquatic food chain. Studies on a wide variety of freshwater fish show that CODIS™ 95 and CODIS™ BIO have very low toxicity to fish.

CONTACT INFORMATION

ADDAPT Chemicals B.V.

Speltdijk 1
5704 RJ Helmond
The Netherlands

Tel.: +31 (0)492 59 75 75
Fax: +31 (0)492 55 29 55
E-mail: info@addapt-chem.com
http://www.addapt-chem.com

Liability
All recommendations for the use of our products, whether given by us in writing, oral, or to be implied from the results of tests carried out by us, are based on the current state of our knowledge. Under no circumstances shall Seller be liable for incidental, consequential or indirect damage for alleged negligence, breach of warranty, strict liability, tort or contract arising in connection with product(s). Seller's sole liability for any claims shall be Buyer's purchase price. Data and results are based on controlled lab work and must be confirmed by Buyer by testing for its intended conditions of use. The product(s) has/have not been tested for, and is/are therefore not recommended for, uses for which prolonged contact with mucous membranes, abraded skin or blood is intended, or for uses for which implantations within the human body is intended.