



Rilsan® fine powder for hot water application

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Testing of Rilsan® under extreme conditions- Water heater application



- Immersion in hot water with frequent refilling of fresh water.
 - Increase of oxygen level
 - Decomposition of bicarbonate forming carbon dioxide and precipitated carbonates increasing the acidity of the medium
 - Formation of anodic environment in the gas rich top and cathodic environment in the liquid phase

Extrapolation

- Tests were conducted at different
 - Temperatures :65, 80 and 95°C
 - Water refill rate*: 6, 12 and 24 refill of 2/3 of the water per day
- An extrapolation formula was developed and validated by tests
- We were able to forecast the life time in actual water heater usage**

* Water refill allows to renew oxygen in the water

Conclusions

- We may expect a lifetime superior to 10 years at 70 °C for Rilsan® fine powder system*
- The expected lifetime increase by two with every decrease of 10~15°C in temperature

Temperature, °C	Lifetime, years
95	1.5
85	3.5
76	7.5
66	13.5

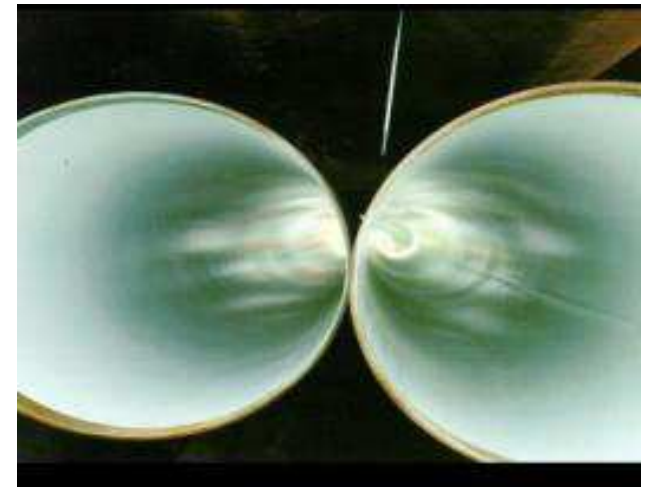
** Those results are based on laboratory applied materials and required specific application procedures

Simulation of usage conditions or Rilsan® - oil&gas applications

10 days in autoclave

Medium: 2/3: salt water (3%) with 10% gas oil, the whole saturated with CO₂,
1/3: methane with 10%CO₂+10%H₂S

Evaluation: Blistering, change of colour and cracking



Conclusion on usage conditions:

Temperature: superior to 70°C, inferior at 100 °C)

Pressure: up to 150bar (the highest pressure tested)

Decompression rate: withstand instantaneous decompression

Water Industry Approval



- AS/NZS 4158.1—hot water immersion test according to AS 3862/AS1580.408.2 at 60°C for 100days. Adhesion rating before and after exposure of 4
- WIS 4-52-01—hot water immersion test at 50°C for 14days. No loss of adhesion before and after exposure

Reference-Hot sea water

Seawater Cooling System Pipeline



Owner **Blue Star Ferries cruise ship**

Year **2000**

Engineering **Van der Giessen de Noord**

Application **Pumping of sea water for cooling of the engine through
heat exchanger and discharge of hot seawater up to 70°C**

Reference-Hot venace transportation

Transportation of Venace



Physical-Chemical Proprieties of Vinace	
Pressure (kgf)	4
pH	4
Temperature (°C)	70
DBO (OBD) (mg/l)	16950
DBQ (OCD) (mg/l)	28450
ST (Total of Solids) (mg/l)	25155
Chemicals (mg/l)	-
N	357
NH3	11
P	60
K	2035
Ca	515
Mg	226
Mn	5
Fe	25
Na	52
Cl	1219
S04	1538
S03	36
Ethanol (% volume)	0,09
Yeast (% volume)	1,35
Glicerol (% volume)	0,59

<u>Date</u>	Started in 2002
<u>Country</u>	Brazil
<u>Products</u>	6m straight pipes
<u>End Use</u>	Transportation of venace (by product of alcohol production)
<u>Customers</u>	Producers of alcohol from fermentation of sugarcane

Rilsan® in oil and gas industry



Coated tubing produced by Tuboscope

End Use:

Production and Injection Tubings as well as flow lines for oil & gas production

Service conditions:

CO₂, fresh and salt water, oil and gas to 80°C

