



INTERNATIONAL WORKSHOP ADVANCES IN CLEANER PRODUCTION

"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

New Paint without the Use of Coal Tar

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Abstract

Due to the Sherwin-Williams concern about the environmental impact and reduction of the hazards in all the supply chain, Sherwin-Williams has developed low toxicity coatings, EPOXY TAR FREE. This painting was developed and introduced in the market with the intention of substitution of EPOXY TAR BASE coatings, which exhibit high inherent toxicity, due to the PITCH, the main raw material of these types of paints. This work has as objective, to demonstrate through comparative tests among TAR base coatings, traditionally used versus the new product TAR Free, some laboratory tests and economical study to show the efficiency of the new product.

Keywords: Tar Free, Epoxy coatings, clean production.

1. Introduction:

1.1 Coal tar (1):



Figure 1: Coal tar (1).

Coal tar (figure 1) is a brown or black liquid of high viscosity, which smells of naphthalene and aromatic hydrocarbons. Coal tars are complex and variable mixtures of phenols, polycyclic aromatic hydrocarbons (PAHs), and heterocyclic compounds.

1.1.1 Applications:

Being flammable, coal tar is sometimes used for heating or to fire boilers. Like most heavy oils, it must be heated before it will flow easily.

It can be used in medicated shampoo, soap and ointment, as a treatment for dandruff and psoriasis, as well as being used to kill and repel head lice. When used as a medication in the U.S., coal tar preparations are considered an OTC (over-the-counter drug) pharmaceutical and are subject to regulation by the United States Food and Drug Administration.

Name brands include Denorex, Balnetar, Psoriasin, Tegrin, T-Gel, and Neutar. Coal tar is also used to synthesize acetaminophen, or Tylenol.

Coal tar was formerly used as one of the primary ingredients of asphalt pavements. Tar is used in treatment of the skin disease psoriasis, where coal tar is the most effective. Petroleum tar was also used in ancient Egyptian mummification circa 1000 BC.

1.1.2 Safety:

According to the International Agency for Research on Cancer, preparations that include more than 5 percent of crude coal tar are Group 1 carcinogen.

According to the National Psoriasis Foundation and the FDA, coal tar is a valuable, safe and inexpensive treatment option for millions of people with psoriasis and other scalp conditions. Coal tar concentrations between 0.5% and 5% are safe and effective for psoriasis, and no scientific evidence suggests that the coal tar in the concentrations seen in non-prescription treatments is carcinogenic. The NPF states that coal tar contains approximately 10,000 different chemicals, of which only about 50% have been identified, and the composition of coal tar varies with its origin and type of coal (e.g.: lignite, bituminous or anthracite) used to make it.

1.1.2.1 Effects of the product:

Toxic to human health and environment;

Adverse Effects the human health: Toxic by consumption and inhalation;

Environmental Effects: Risk of poisoning by atmospheric, water contamination and soil;

1.1.2.2 Toxicological information:

Acute toxicity: It is produced by the inhalation of big quantities of vapors of at one short period of time. Its effect happens in the central nervous system, shown up by the narcotic action (anesthetic);

Local Effects: Irritation of the eyes and in the respiratory system. Headache, drowsiness and depression of the central nervous system;

Chronic toxicity: Occurs due to repeated exposition the small concentrations, by long periods of time. His effect happens in the blood (and in the organs that produce it). The effects provoked in the bone marrow are irreversible;

Specific Effects: Serious poisoning, irritations of allergic origin.

2. The combination with the Epoxi:

Coal Tar is an excellent resistant and waterproof covering to many chemical products, but is **thermal plastic** and drains in vertical surfaces with the heat. The Epoxi is **thermal fix**, has also resistance to several chemicals and in combination with the coal tar provides a more waterproof a lot covering with high chemical resistance and that does not soften with the heat. These two materials produce an extremely interesting result of the point of view of synergy. However, the association with the pitch brings the inconvenient of the inherent toxicity to the Coal Tar.

3. Results

3.1 Test results:

It was studied the new painting (Tinta Tar Free) and the conventional one (Tinta N-1265). The tables 1 to 9 shows the results obtained.

Table 1 – Measurement of the thickness of the paint layer.

| Paint | Thickness (µm) | | |
|----------------|----------------|---------|---------|
| | Minimum | Average | Maximum |
| Tinta N-1265 | 260-304 | 288-322 | 307-345 |
| Tinta TAR-FREE | 286-343 | 305-376 | 331-422 |

Table 2 – Results of the adherence study (initial condition).

| Paint | Adherence (method) | | |
|----------------|--------------------|-------------------|----------------------|
| | ABNT NBR 11003 A | ASTM D 4541 (MPa) | Fail nature |
| Tinta N-1265 | X0 Y0 | 15,4 | B (cohesive) |
| Tinta TAR-FREE | X0 Y0 | 16,0 | (50%-/Y) e (50% Y/Z) |

Table 3 - Results of the resistance study (NaOH 20%, 25°C±2°C, 3160 h)

| Paint | Color change (ISO 4628/1) | Corrosion (ISO 4628/3) | Empolamento (ISO 4628/2) | Fendimento ISO 4628/4 |
|----------------|---------------------------|------------------------|--------------------------|-----------------------|
| Tinta N-1265 | 0-1 | Ri 0 | 0 | 0 |
| Tinta TAR-FREE | 0 | Ri 0 | 0 | 0 |

, Table 4 - Results of the resistance study (H₂SO₄ 30%, 25°C±2°C, 3160 h)

| Paint | Color change (ISO 4628/1) | Corrosion (ISO 4628/3) | Empolamento (ISO 4628/2) | Fendimento (ISO 4628/4) |
|----------------|---------------------------|------------------------|--------------------------|-------------------------|
| Tinta N-1265 | 0-1 | Ri 0 | 0 | 0 |
| Tinta TAR-FREE | 0 | Ri 0 | 0 | 0 |

Table 5 - Results of the immersion in salt water study (NaCl 3,5%, 40°C±2°C, 3570 h)

| Paint | Color change (ISO 4628/1) | Corrosion (ISO 4628/3) | Empolamento (ISO 4628/2) | Adherence (method) | | |
|----------------|---------------------------|------------------------|--------------------------|--------------------|-------------------|-----------------------|
| | | | | NBR 11003 | ASTM D 4541 (MPa) | Failure nature |
| Tinta N-1265 | 0-1 | Ri 0 | 0 | X0 Y0 | 9,0 | B (cohesive) |
| Tinta TAR-FREE | 0 | Ri 0 | 0 | X0 Y0 | 11,5 | Y (cohesive adhesive) |

Table 6 - Results of the immersion in distilled water (40°C±2°C, 3570 h)

| Paint | Empolamento (ISO 4628/2) | Corrosion (ISO 4628/3) | Fendimento (ISO 4628/4) | Adherence (method) | | |
|----------------|--------------------------|------------------------|-------------------------|--------------------|-------------------|---------------------|
| | | | | NBR 11003 | ASTM D 4541 (MPa) | Failure nature |
| Tinta N-1265 | 0 | Ri 0 | 0 | X0 Y0 | 10,4 | B (coesiva) |
| Tinta TAR-FREE | 0 | Ri 0 | 0 | X0 Y0 | 13,0 | Y (coesiva adesivo) |

Table 7 - Results of the corrosion penetration into a incision after conclusion of the exposition to a salty mist (4056 h) according to ASTM B 117.

| Paint | Alteration of | | Empolamento (ISO 4628/2) | Corrosion (ISO 4628/3) | Fendimento (ISO 4628/4) | Gizamento (ISO 4628/6) | Corrosion penetration into the incision (mm) |
|----------------|--------------------|-------------------------|--------------------------|------------------------|-------------------------|------------------------|--|
| | Color (ISO 4628/1) | Brightness (ISO 4628/1) | | | | | |
| Tinta N-1265 | 0 | 0-1 | 0 | Ri 0 | 0 | 0 | 1,8 |
| Tinta TAR-FREE | 0 | 0-1 | 0 | Ri 0 | 0 | 0 | 3,5 |

Table 8 - Results of the adherence study, after the conclusion of the the exposition to a salty mist (4056 h)

| Paint | Adherence (method) | | |
|----------------|--------------------|-------------------|----------------------|
| | NBR 11003 A | ASTM D 4541 (MPa) | Failure nature |
| Tinta N-1265 | XO YO | 9,0 | B (coesiva) |
| Tinta TAR-FREE | XO YO | 14,8 | -/Y (adhesive/tinta) |

Table 9 – Study according to the Resolução nº 105 of ANVISA–MS (performed in the TECPAR – Technical paper number 06011420)

| Total Migration | Tinta TAR-FREE | Resolução nº 105 |
|-----------------------------------|------------------------|--------------------------|
| Deionized water (10 days at 40°C) | 1,5 mg/dm ² | < 8 mg/dm ² |
| Specific metal migration | Tinta TAR-FREE (mg/kg) | Resolução nº 105 (mg/kg) |
| Zinc (Zn) | 0,06 | < 50,0 |
| Antimony (Sb) | < 0,05 | < 2,0 |
| Lead (Pb) | < 0,05 | < 0,8 |
| Tin (Sn) | < 0,05 | < 250,0 |
| Arsenic (As) | < 0,02 | < 1,0 |
| Copper (Cu) | < 0,02 | < 30,0 |
| Mercury (Hg) | < 0,01 | < 0,01 |
| Chromium (Cr) | < 0,005 | < 0,1 |
| Cadmium (Cd) | < 0,002 | < 1,0 |

3.2 Comments:

In the incision test, the Tinta N-1265, showed a superior performance when compared with the Tinta TAR-FREE because had an inferior penetration of the corrosion.

Related to adherence (initial tests and after the tests) both paints presented a very good result. In addition to these good results, we did not notice any release of the painting.

In the chemical treatment (sulfuric acid and sodium hydroxide), in the anti-corrosion property, both paintings presented a very good protection.

The paint TAR-FREE presents a higher amount of solids per volume, classifying it as a high solid paint (HS – High Solids) and low volatile organic compounds (VOC) to this category of paint (144 g/L). The paint did not present heavy metal (such as Lead, Chromium, Cadmium and Mercury) in its composition, which classifies it as a heavy metal-free paint.

4. Conclusions

4.1 General

Today it is possible elaborate paints that do not contain tar, so good for some application that in the past, just the coal tar epoxy attended. Laboratory tests showed that the new paint (TAR FREE) is very similar to the conventional one (N-1265).

The new paint (TAR FREE) does not contain the coal tar that is very toxic to humans and to the environment and when the consumption of toxic product happens, the whole supply chain (coal tar production, packaging, transportation, analysis, etc) had reduced environmental impact.

4.2 TECPAR Conclusion:

The paint TAR-FREE meets the parameters of the Resolução nº 105 of May 19th, 1999, published by Agência Nacional de Vigilância Sanitária of the Ministério da Saúde, in the Total Migration and specific metal migration to food products type I – non acid food (pH>5).

4.3 Economical aspects:

The price of the new paint (TAR-FREE) is 57,5% higher than the conventional one (N-1265) and 39,2% higher than the high resistance paint (N-1761). Figure 2 shows the price (in reais per square meter).

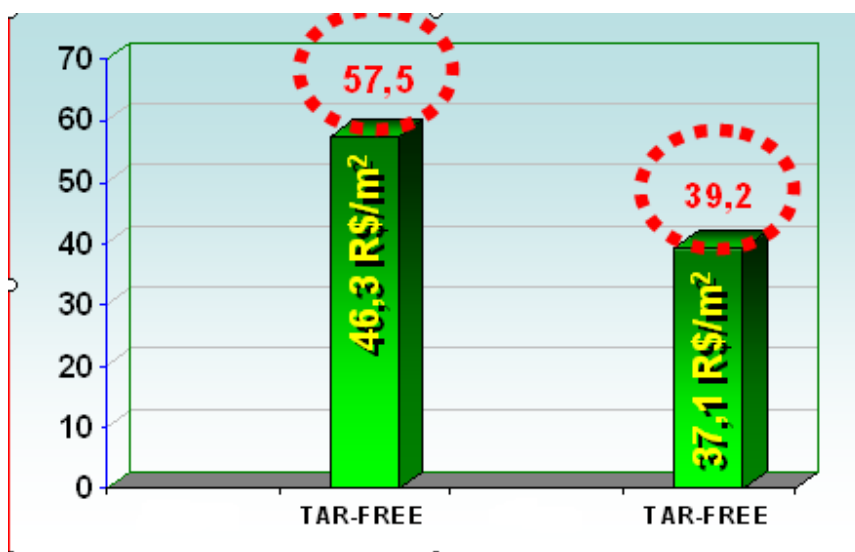


Figure2: Price of the two paints (reais per square meter).

5. References

http://en.wikipedia.org/wiki/Coal_tar

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