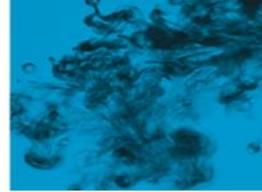




Chemoxy International Ltd

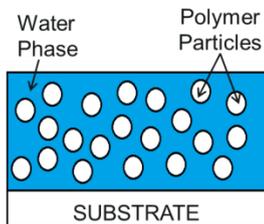
Coalescing Range



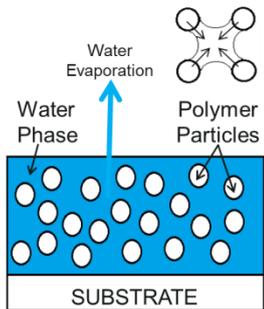


The Process of Coalescing

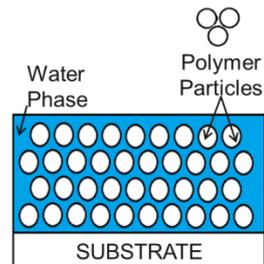
Coalescence is defined as the process by which a uniform and compact film is obtained on drying of organic, polymer-based latex emulsion paints. Coalescent additives promote fusion of the polymer particles to form a uniform and compact film by softening the polymer particles and allowing them to fuse together.



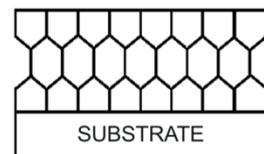
When the surface coating is applied to the substrate, small polymer particles are dispersed throughout the aqueous phase and are free flowing. These particles range from 0.1-0.2 μm in diameter.



The particles arrangement into a cubic form takes place, due to the evaporation of the water from the system. The surfactant also plays a key part in this stage as it has mutual repulsive forces which inhibit the close packing of the particles.



The water continues to evaporate with the solids occupying 70% of the volume. The polymer particles are forced together by capillary forces



Once the water has evaporated, the inter-particle repulsive forces are overcome by increasing surface tension and the polymer particles coalesce into a continuous film. This will only happen at temperatures above the MFFT.

The choice of Coalescent and its efficacy are fundamental steps in the formulating of Latex paints, as so many of their properties and performance in use are due to the coalescent used.

Coasol® combines an excellent suite of properties to produce non VOC, non-odour coatings and is classed as non VOC under European Directive 2004/42/CE. It meets the criteria requirements for the Ecolabel regulations and GS11 Green Seal. Some of the key properties of **Coasol®** are related to the High Eco-Tox Profile:

- Non-VOC, biodegradable and low odour 'on wall'. Coasol® isn't toxic and is Non HAPS (Hazardous Air Pollutant).
- No esters of butyric acid so no risk of unpleasant odours when paint applied to alkaline walls.
- Biodegradation: 28 days 98%.



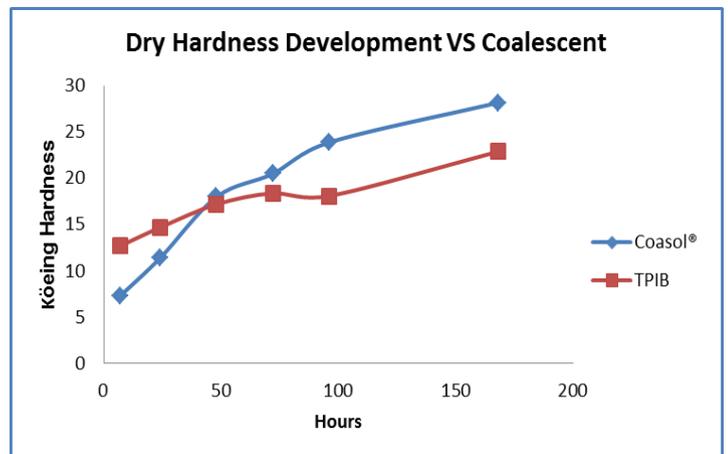
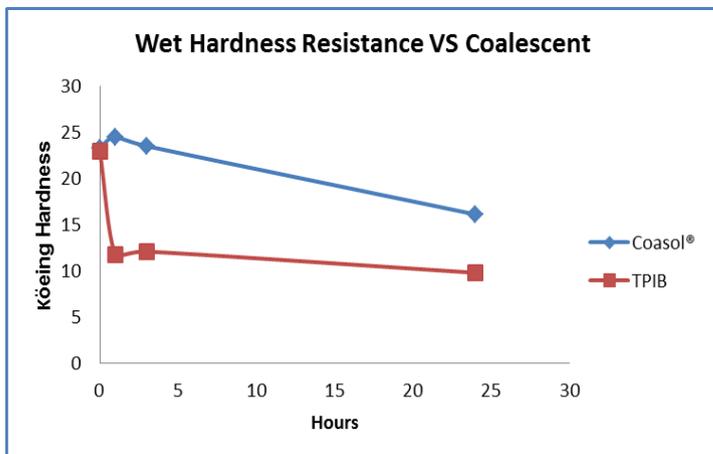
Other key benefits of **Coasol®** are:

- **High Performance & Efficiency**
 - Can use 20-50% less to achieve a low MFFT.
 - Reduced solvent loading to allow incorporation of open time extenders and freeze/thaw protection systems.
 - Improved paint rheology and pigment wetting.
 - Incorporated easily in low shear mixing.
 - Minimal water solubility improves portioning performance.
- **Enhanced film properties**
 - Improved open time enhances film formation.
 - Film integrity and durability improved by drying profile.
 - Excellent water resistance.
 - Improved colour development & minimal impact on gloss.
 - Improved film hardness without cracking.
 - Improved wet rub performance.
 - Resistant to hydrolysis so useable on Alkaline surfaces.

The above not only mean that **Coasol®** products are good coalescents, but that they can impact the amount of other additives used for instance by improving flow and wetting characteristics of the paint, other flow improvers and wetting agents can be added at reduced rates.

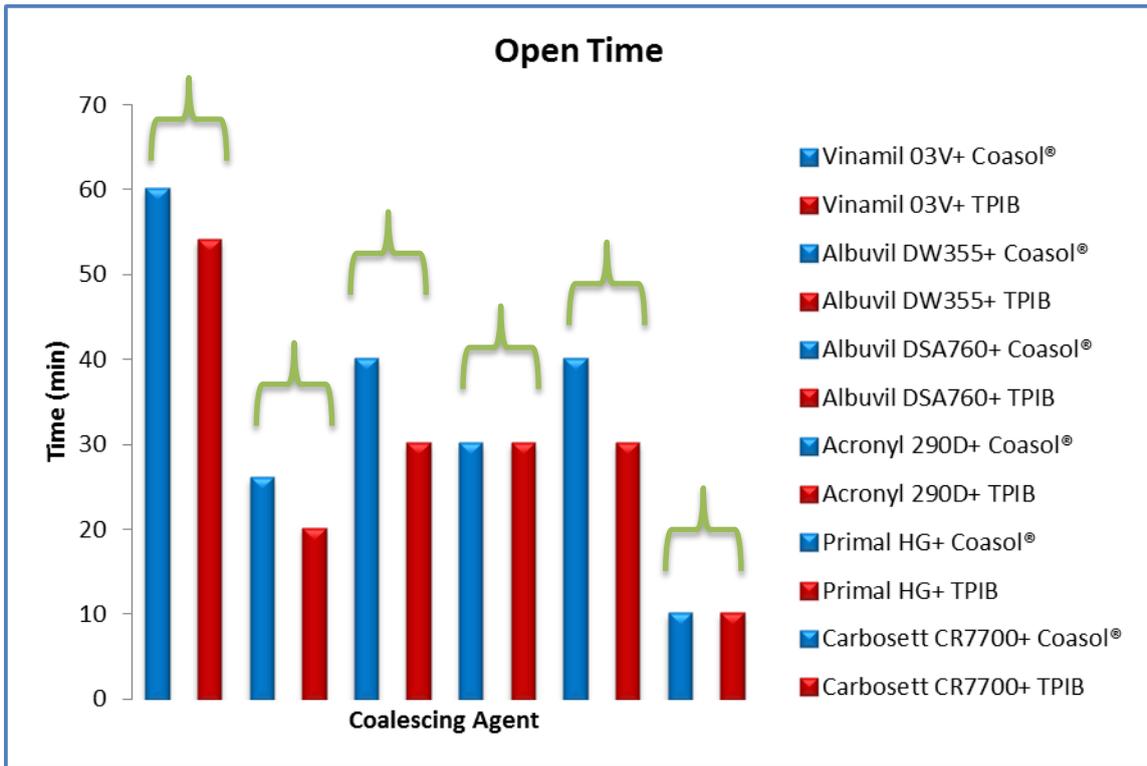
Also, since **Coasol®** products actually have also been proven to stay longer in the film in the first 24 hours compared to other coalescents, they allow excellent film formation, levelling, colour development, water resistance and dirt pick up. Also, after 6 days optimal hardness is achieved as can be seen in the data below.

Similarly, data supports the wet hardness resistance as shown in the data below.

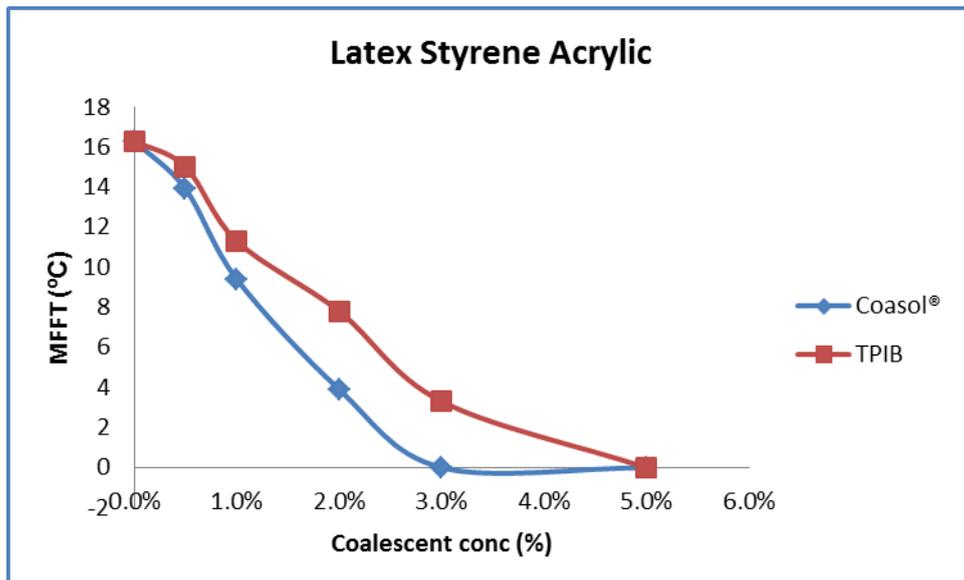




Indeed, as discussed above, even open time can be positively impacted by use of **Coasol®**



When we compare MFFT for instance, clearly there are advantages in many systems as shown below and in Appendix A:



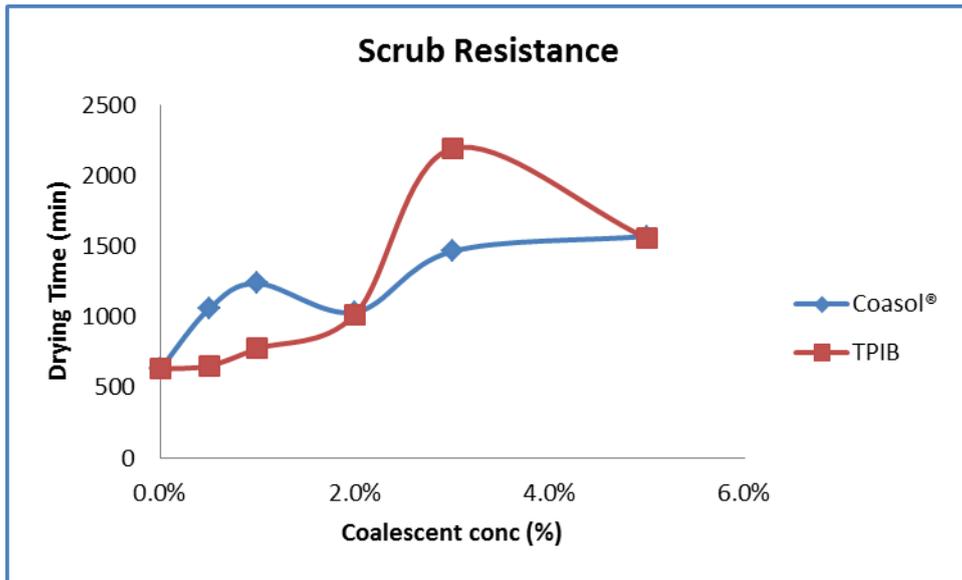


Clearly **Coasol**[®] products can reduce the MFFT and can therefore be used in lower dosage. For example, in the data graph below, in Dow Latex 3433, **Coasol**[®] was the most effective coalescent for decreasing the MFFT, for 1, 2 and 3 %

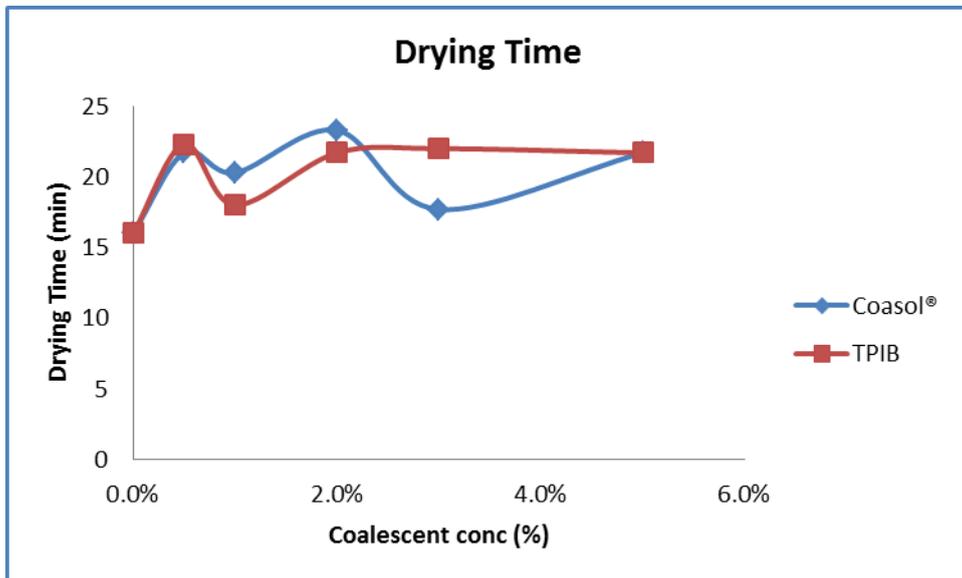
MFFT = 4°C: 2% Coasol[®] or 5% DALPAD C

It is therefore important not to look at **Coasol**[®] products on their own, but to consider the value proposition in the whole formulation.

If we compare some of the key product attributes such as shown below, the scrub resistance, in a typical system (obviously each formulation is different, so actual effects will depend upon formulation and base resin etc.), we can see that **Coasol**[®] performs just as well as, if not better than for example TPIB



Another important test is the drying time – and below we see that this is not adversely impacted by **Coasol**[®] products.

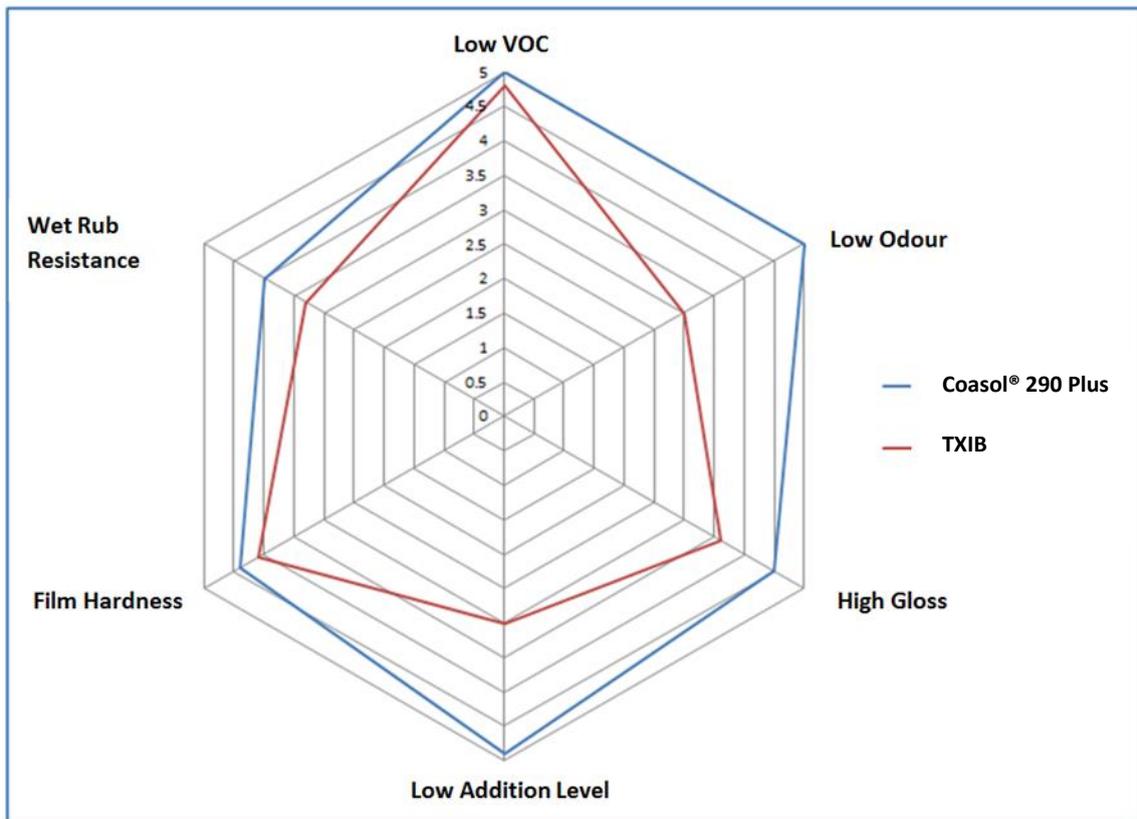




In the paint based on Ucar DL 420G (PVC 55%, VS 35%) only **Coasol® 290 Plus**.

Achieves a class A+ rating after 3 and 28 days.

If we compare similar data to other coalescents, we can see the benefits as shown in the comparison of **Coasol® 290 Plus** for instance, with TXIB:



As new emission and VOC regulations are being adopted across the world, and with ever increasing standards, **Coasol® 290 Plus** is specially designed to meet these standards and maintain a non VOC low odour coating.

Coasol® 290 Plus combines an excellent suite of properties to produce non VOC, non-odour coatings and is classed as non VOC under European Directive 2004/42/CE. It meets the criteria requirements for the Eco label regulations and GS11 Green Seal, and the newer standards such as the French regulations.

Key Features of **Coasol® 290 Plus** are the same as **Coasol®** with the added advantages:

- Higher Boiling Point 290 °C.
- High Eco-Tox Profile
- Meets various VOC standards.



Applications:

- **Coasol® 290 Plus** is a very high performance coalescing system which gives the formulator flexibility to achieve low VOC targets whilst improving paint performance in a number of areas.
- **Coasol® 290 Plus** finds an application in industrial cleaners where its eco-profile distinguishes it from other technologies. It is used in hard surface cleaners, as a component in printing paint cleaners, for removal of floor wax. Certain Graffiti removal formulations use its high degree of solvency. It is also used in nail polish removing formulations.
- **Coasol® 290 Plus** is used with unsaturated polyester resins or epoxy resin systems, and can be used as a low tail solvent in coil coatings, or to reduce VOC in high solid formulations.
- **Coasol® 290 Plus** has been used in a number of oil-field applications including low temperature fluids, wax dispersion and degreasers.

Applications:

- **Coasol®** is a very high performance range of coalescing systems which give the formulator flexibility to achieve low VOC targets whilst improving paint performance in a number of areas.
- **Coasol®** products find applications in industrial cleaners where its eco-profile distinguishes it from other technologies. It is used in hard surface cleaners, as a component in printing paint cleaners, for removal of floor wax. Certain Graffiti removal formulations use its high degree of solvency.
- **Coasol®** products are used with unsaturated polyester resins or epoxy resin systems, and can be used as a low tail solvent in coil coatings, or to reduce VOC in high solid formulations.
- **Coasol®** products have been used in a number of oil-field applications including low temperature fluids, wax dispersion and various rig cleaning applications.

Summary

The **Coasol®** range of products is the best choice for a coalescing agent – they are:

- **Versatile**

Coasol™ products are compatible with a wide range of Latexes including styrene acrylates. Methacrylate and Vinyl co-polymer systems

- **Efficient**

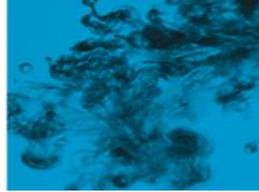
Very low levels of Coasol™ are needed to give excellent film integrity, colour development and scrub resistance

- **Easy to use**

Incorporated easily using TRM or high shear stirring. Time to partition most latex is good.

- **Have the Highest Eco-Tox profile**

Zero VOC, Zero Odour on drying, renewable carbon sources. Does not contain esters of butyric acids that are responsible for 'sick wall' syndrome.



Appendix A:

