Description

Image

Image caption

(1) Oil paints soluble in water © Stux at Pixabay [Public domain] (2) Painted and lacquered Kokeshi Kids © Thor at Wikimedia Commons (CC BY 2.0)

The process

WATER-BASED (or LATEX) PAINTS are synthetic resins and pigments, plus coalescing agents, that are kept dispersed in water by surfactants. They dry by evaporation of the water; the coalescing agents cause the particles of resin to fuse together (coalesce) as the water evaporates to form a continuous coating. Water-based paints are displacing those based on organic solvents because their volatile organic compound (VOC) content is much lower, thereby reducing VOC emissions and air pollution.

Process schematic

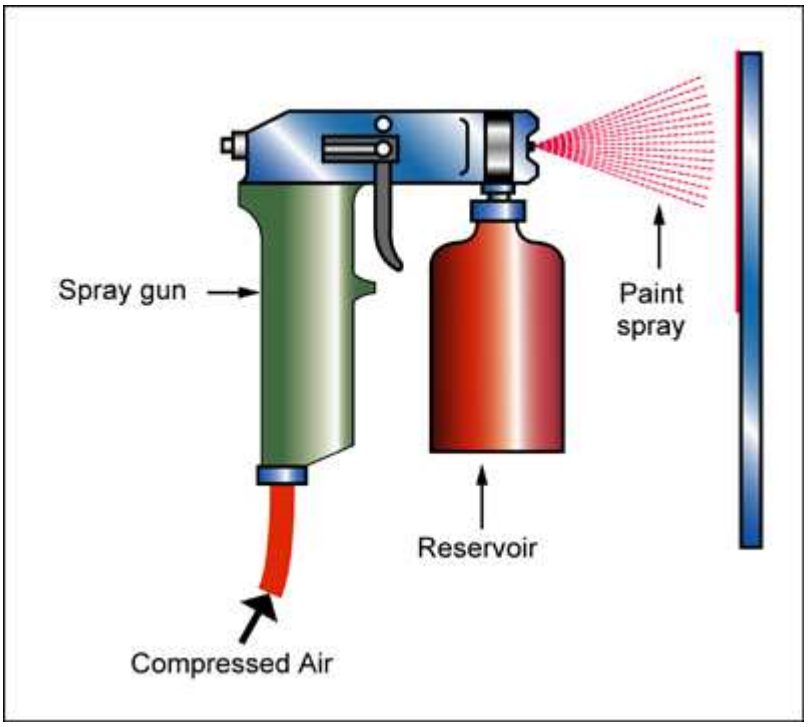

Figure caption

Water-based painting

Material compatibility

Ceramics	✓
Composites	✓
Glasses	✓
Metals - ferrous	✓
Metals - non-ferrous	✓
Natural materials	✓
Polymers - thermoplastics	✓
Polymers - thermosets	✓

Function of treatment

Corrosion protection (aqueous)	✓
Corrosion protection (organics)	✓
Electrical insulation	✓
Decoration	✓
Color	✓
Reflectivity	✓

Economic compatibility

Relative tooling cost	low			
Relative equipment cost	medium			
Labor intensity	medium			

Physical and quality attributes

Surface roughness (A=v. smooth)	A			
Curved surface coverage	Good			
Coating thickness	10	-	200	µm
Surface hardness	5	-	10	Vickers
Processing temperature	16.9	-	76.9	℃

Process characteristics

Discrete	✓
Continuous	✓

Supporting information

Design guidelines

Water-based paints are based on acrylic, urethane, polyvinyl acetate (PVA) or epoxy dispersions. Acrylic emulsions are used in exterior applications where their non-yellowing characteristics, as well as excellent weatherability, are outstanding. Water-based urethanes are suited to uses where good flexibility and toughness are important, such as leather and polymer coatings, but their major drawback is their high cost. PVA and epoxies give good weathering resistance. Water-based paints take longer to dry than many organic solvent based paints, and give a surface finish that is less good.

Technical notes

Water-based paints must be protected from freezing and applied at a minimum temperature of 10 C. Humidity and temperature control are critical for the drying time. A heat cure is sometimes necessary. Pigments must be compatible with water. Metallic particles are usually coated before being mixed into the paint to prevent chemical reaction with water. Many conventional binders (alkyls, acrylics, and epoxies) can be made water-soluble by chemically attaching polar groups such as carboxyl, hydroxyl, and amide. Dispersions are very small particles of binders, less than 0.1 microns diameter, dispersed in water. Emulsions, or latex, are water dispersions that differ from dispersions by having much larger particle size on the order of 0.1 micron or more. They are made by precipitation in water and therefore do not need to be dispersed.

Typical uses

Applications, growing rapidly, include flooring, wood lacquers, decorative paints, automotive coatings, plastic coatings, inks and adhesives.

The economics

Solvent-based paint systems can usually be converted to water-based paint systems with a limited capital investment. The cost of water-based paints depends on the type; they can be less expensive than the solvent-based equivalent.

The environment

Water-based paints reduce VOC emissions and worker exposure to toxic pollutants, and present no fire hazard. They are displacing solvent-based paints because of their cost, fire risks and toxic fumes, although these dry fast, give a better surface finish with better adhesion.

Links

MaterialUniverse

Reference