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The Importance of Resin Flooring within the Safe Design of a Food Processing Facility

Food safety is vital for consumer confidence and the hygienic design of food processing facilities is central to the production of safe food and beverage products. The sensitive nature of food processing environments and subsequent risk of contamination demands that food safety be factored into the design and construction of a food or beverage facility at planning stage.

Why Do I Need a Protective Resin Flooring System?

The floor of a food processing facility is subject to a wide variety of food by-products, including fats, hot oils, blood, sugar solutions and natural food acids. Many of these substances can cause untold damage to an uncoated concrete floor due to their corrosive nature. Additionally, these substances can infiltrate the concrete material resulting in microbial growth and the spread of bacteria, which will in turn degrade not only the production environment but in instances may contaminate the products themselves.

On top of this, punishing cleaning and maintenance processes including steam cleaning, power washing, hot water washdowns and the use of aggressive cleaning agents can place a significant amount of stress on the floor. On an uncoated concrete surface this could lead to significant damage.

Steam cleaning and hot water washdowns are likely to put undue stress on the concrete slab, whereas power washing will begin to eat away at the surface and expose the concrete's weakness. The use of aggressive cleaning chemicals corrodes the unprotected concrete, leaving it ripe for bacterial penetration as it becomes more and more porous.

For all of these reasons it is non-negotiable that an exposed concrete slab is covered with a high-performance flooring system where consumable food

and beverage products are produced, processed, packaged or stored. Today, seamless resin-based surfaces are increasingly being specified in these environments on account of the material's hygienic profile and hardwearing performance characteristics.

What Resin Flooring Options are Available?

This is a big question asked by industrial facilities managers and plant operators working within the food and beverage industry.

Resin flooring systems are available in a wide range of shapes and sizes and have been designed to best meet the different working areas within a food or beverage plant - all of which will be subject to different operating conditions.

Cementitious Polyurethane

Cementitious polyurethane systems are a popular choice for clients working in the food industry. A typical polyurethane material used in this application comes in mortar form combining cement and water-based technologies that exhibit a high cross-linked density, making them ideal for abusive environments subject to prolonged chemical attack.

Polyurethane resin systems exhibit a thermal coefficient of expansion, which is similar to that of concrete. This offers excellent benefits when installed directly over concrete in environments subject to

thermal shock and thermal cycling as it prevents the material from cracking when subject to large temperature swings.

Cementitious polyurethane resin flooring solutions are non-porous, preventing bacteria and mould spores from surviving in joints or cracks typical of alternative flooring systems such as tiles or acid bricks. They are also low odour as well as non-toxic and non-hazardous.

Methyl Methacrylate (MMA)

Methyl methacrylate (MMA) systems offer food manufacturing and processing environments certain performance advantages compared to alternative resin materials, most notably their ability to cure at an incredible speed and be installed at extremely low temperatures.

MMA resin can fully cure in just one to two hours, making it an ideal choice for operational facilities looking to minimise downtime and disruption as well as fast-track new-build construction projects.

MMA resin material demonstrates a high level of resistance to UV light as well as a range of acids and alkalis. Although MMAs have a unique odour, the odour is harmless and can be minimised during installation with proper ventilation.



TIP:

Use polyurethane systems in areas prone to thermal shock conditions.

TIP:

Polyurethanes are resistant to most substances found in the food industry.

Epoxy

Epoxyes are typically trowel or roller-applied, two or three-component systems that are available in a wide variety of colours. Epoxyes can also be broadcast with aggregates to deliver a slip-resistant finish.

Epoxyes offer limited resistance to organic acids, which are found in a large quantity of natural foodstuffs. However, epoxyes offer no resistance to thermal shock making them more susceptible to cracking and de-bonding in more rigorous food and beverage environments.

Epoxy resin surfaces are a good choice for non-processing zones of a food manufacturing facilities such as packaging, maintenance and staff break-out areas as well as corridors, lobbies and office spaces, which are not subject to the same high protection demands.

Factors to Consider When Selecting a Resin Flooring System

Understanding the most important operational criteria and service requirements of the facility or area in question is central to specifying a resin flooring system that will best meet your needs.

Hygiene

Resin flooring systems offer clients an enhanced hygiene performance resulting from a seamless finish combined with the material's excellent durability and resistance. However, further innovations are also available to make the finished surface more effective.

Antimicrobial additives can be incorporated within the resin matrix of a polyurethane system in order to offer complete surface protection against harmful bacteria, mould and yeasts.

Flowcrete Group Ltd has an exclusive partnership with Polygiene® – a manufacturer of natural silver ion-based antimicrobial additives.

Polygiene® can positively inhibit the growth of gram positive and gram negative bacteria including SARS, E-coli, MRSA, C.difficile and Salmonella typhi amongst others. International studies show a 99.9% reduction in the bacterial population on the surface of a polyurethane floor containing Polygiene®.

Unlike many antimicrobial alternatives, this protection remains active for the lifetime of the floor, even if worn or damaged, offering clients' a long-term hygiene performance.

Slip Resistance Requirements

It is imperative that all floors in food manufacturing and preparation zones, as well as staff breakout areas and amenities, have a non-slip surface, so as to prevent slips and trips.

Considering the floor finish in terms of risk management is even more critical in wet service environments as is ensuring the flooring system is tested under these conditions to determine if it will provide the correct level of safety.

In wet service environments, it is essential that flooring is laid to falls leading to an efficient drainage system in order to prevent the pooling of water and heighten the risk of slips.

Resin flooring is available in a range of textures and can be graded with broadcast aggregates in order to increase the anti-slip profile of the product. It is important to note that coarsely textured surfaces, such as positively graded resin systems, are more difficult to keep clean, therefore a compromise may need to be made where heavy slip resistance and ease of cleaning are both of critical importance.

Antimicrobial Activity After 60 Wash Cycles

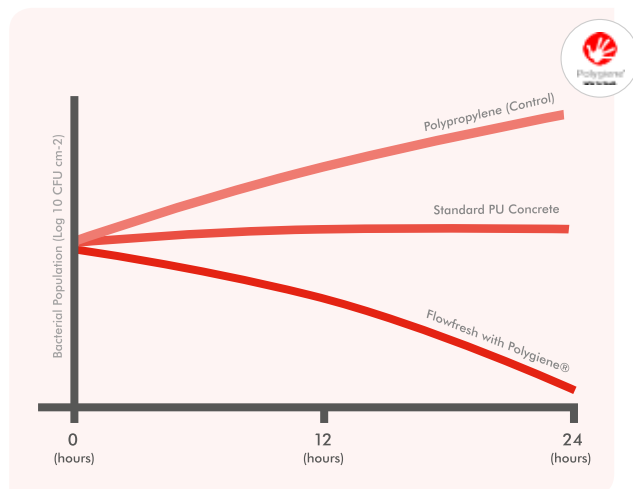


FIGURE 1: Japanese Industrial Standard JIS Z 280: 2000 measures the survival of bacterial cells on cementitious polyurethane with Polygiene® and compares this to polyurethane concrete containing no antimicrobial additive and an untreated polypropylene control.



Nature of Chemical Contact

A wide range of organic and inorganic acids, alkalis and salts as well as hot oils, blood, sugars and fats are common place in food and beverage production facilities making these environments ripe for chemical attack.

Chemical attack is typically described as the breaking down of the floor's polymer structure such that it is no longer able to fulfil its function. To that end, it is crucial to ensure that the resin flooring system you choose caters to the chemical conditions to which your environment is subjected.

Failure to anticipate the prolonged nature or degree of chemical attack may result in erosion of the surface, softening or embrittlement as well as blistering or delamination.

There are many factors that will affect the chemical resistance profile of a resin flooring system including its thickness, resin / polymer basis and reactivity of the chemical agent.

By far and away the most effective method of protection against chemical attack is a polyurethane system. The material offers a significantly enhanced resistance to corrosive substances, solvents and foodstuff by-products, particularly organic acids, when compared to epoxy or MMA systems.

Chemical Substance	Cementitious Polyurethane	Epoxy	MMA
Hydrochloric Acid	●	○	●
Sulphuric Acid	●	○	●
Citric Acid	●	●	○
Oleic Acid	●	-	-
Acetic Acid	●	-	●
Lactic Acid	●	○	●
Ethanol	●	●	-
Methanol	●	-	-
Sugar Syrups	●	●	-
Caustic Soda	●	●	●
Blood	●	●	●
Oil Ingredients	●	●	●
Detergents	●	●	●
Beer	●	●	●
Wine	●	○	○
Whiskey	●	○	○

● High Resistance ○ Limited Resistance - No Resistance

FIGURE 2: Chemical Resistance of Resin Flooring Comparison Chart: Flowcrete Group Ltd, 2013.

Thermal Shock & Cycling

Food and beverage processing plants and certain agricultural facilities can create thermal shock conditions, whereby the ambient temperature changes significantly and almost immediately, which can lead to floor failure if the material has not been specified correctly.

Most often, thermal shock happens when facilities that usually remain at room temperature are cleaned using very hot water or steam to remove stubborn blood, grease and other chemical contaminants.

This immediate change will cause the floor finish to expand or contract at a different rate to the substrate, leading to cracks, bubbling, peeling or delamination.

Cementitious polyurethane systems are much better equipped to deal with thermal shock and extreme temperature fluctuations than epoxies or MMAs. Polyurethane systems have a coefficient of thermal shock that is similar to that of concrete, allowing

the material to expand, contract and move with the substrate, preventing any lasting damage.

In cold stores and blast freezers, or alternatively in areas with furnaces or underneath hot ovens, care must be taken to ensure that an appropriate flooring system has been selected to withstand long periods of exposure to hot temperatures. In these instances, thick cementitious polyurethane systems are recommended.

Cleaning & Maintenance

Floors are well known to take more abuse than any other surface within a food environment, as a result of the chemical substances and punishing conditions to which they are subjected.

As a result, an effective cleaning and maintenance routine should be in place to preserve the aesthetic and performance of the resin finish. Resin flooring will not be affected by most special purpose cleaning materials, when these are used in accordance with the Chemical Cleaning Manufacturers’ instructions. Specific cleaning instructions should also be sought from the resin flooring manufacturer.

A small spot test in an inconspicuous area is a worthwhile precaution before applying any new cleaning product. The cleaning regime should specify the type of equipment to be used, the type of cleaning chemicals to be used and the frequency of the cleaning and temperature.

It is important to note that cementitious polyurethane systems are compatible with steam cleaning and hot water washdown cleaning methods, whereas this is not recommended for epoxy or MMA systems.

This guide has been produced to give an overview of the resin choices available and factors to consider when specifying a resin flooring system within a food and beverage facility.

Detailed recommendations and advice is available from our network of regional technical and sales representatives.