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Perspective

Authentication of Ceramic Food Packaging Materials in Acid Food Simulants

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DESCRIPTION

Lead was also the least leachable of these four dangerous metals, whereas nickel was the most leachable. The ratios of the lead, cobalt, nickel, and zinc oxides in the glaze and their release in the liquid didn't correspond, indicating that the process of removing these dangerous metals was inconsistent with dissolution. If ceramic food storage containers that were frequently used to store a wide range of foodstuffs, such as mature vinegar, aromatic vinegar, and other more extractive acidic foodstuffs, were decorated with the incorrectly formulated glazes and fired in an inappropriate manner, lead and other toxic metals would not be chemically combined closely in the glass structure, which will yield a high release of harmful toxic metals when contacting the foodstuffs. Since lead and cadmium have cumulative and systemic toxicity, even modest quantities of everyday exposure to them can harm the immunological, reproductive, neurological, and other systems. Lead and cadmium have been regarded as substantial risks for humans due to their acute toxicity, and numerous measures have been made to lessen or avoid their consumption.

The authorities in many nations have employed national legislation and international standards to monitor and control the potential discharge of lead and cadmium from all conceivable sources. Cobalt, nickel, and zinc were found in several varieties of glazed ceramic pottery, in addition to lead and cadmium. All of these metals are trace elements that are vital to human health and are generally thought to be relatively harmless, although prolonged overconsumption can be harmful to people's health. Studies on the migration of these dangerous metals into foods or their extraction from ceramic wares into food products are, however, uncommon, and there are few laws or regulations in place to watch over and control any potential release of these metals.

The behaviour of cobalt, nickel, and zinc as they leach from ceramic wares must thus be studied in order to assess the possible health risks. Another significant poisonous metal that caused concern was cadmium, which is now being studied and will be covered in further depth elsewhere. Although 4% acetic acid solution was acknowledged as the most harsh test solution for typical drinks, other studies have shown that lead is eliminated as acid strength is increased. A higher pH than that of 10% acetic acid is found in 4% acetic acid, which has a value of around 2.45. Moreover, lactic acid is predominantly present in sour milk products and is also included in certain processed meals either as a pH modifying component or as a preservative, which are more relevant for food ceramic packing. Citric acid is present in all animal tissues and fluids. Cadmium in ceramic glazes was also an important toxic metal of concern, which is under study now and will be discussed in detail elsewhere. 4% acetic acid solution was recognized as the most severe test solution for common beverages, but many researches also reported that lead is removed with the increase of acid strength. The pH value of 4% acetic acid is about 2.45, which is higher than that of 10% acetic acid. Moreover, lactic acid is predominantly present in sour milk products and is also included in certain processed meals either as a pH modifying component or as a preservative, which are more relevant for food ceramic packing. Citric acid is present in all animal tissues and fluids. Due to this, in addition to 4% acetic acid, 10% acetic acid, 1% citric acid (pH 2.21), and 1% lactic acid (pH 2.23) were also used in this work as test solutions for leaching lead and other harmful metals from ceramic food packing containers. The present study aims to: (1) investigate the kinetics of lead, cobalt, nickel, and zinc removal from ceramic food packaging materials into acid food simulants; (2) determine whether the amount of these metals removed and their ratio in the glaze coincide or not; (3) examine the effect of temperature on the removal of these toxic metals; and (4) investigate the impact of the pH value of the food simulant.

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