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MITSUBISHI GAS CHEMICAL COMPANY, INC.

Development of an Ultra-High-Sensitivity Analytical Method for Pyrroloquinoline Quinone (PQQ) in Human Breast Milk and Plasma

Research Cooperation with Nagasaki University on the Mechanisms of PQQ Transfer and Secretion into Breast Milk

Mitsubishi Gas Chemical Company, Inc. (MGC; Head Office: Chiyoda-ku, Tokyo Japan; President: Yoshinori Isahaya) has in a joint research project with Professor Naoya Kishikawa of the Department of Analytical Chemistry at Nagasaki University developed a new high-performance liquid chromatography (HPLC) analytical method capable of detecting pyrroloquinoline quinone (PQQ) at levels as low as one trillionth of a gram (0.22 nM). Researchers from the University of Tabuk in Saudi Arabia, a joint research partner of Nagasaki University, also participated in this study.

These research findings contribute to advancing nutritional research on bioactive components in breast milk and the maintenance of maternal and infant health. On October 1, 2026 the findings were published in the “Microchemical Journal” *1.

PQQ possesses a variety of physiological activities, including supporting the maintenance of mitochondrial function within cells, energy production, and antioxidant effects. In 2008, MGC pioneered the development of PQQ disodium salt, a water-soluble salt of PQQ, as a functional food ingredient, which is marketed worldwide under the brand names “BioPQQ™” and “MGCPQQ™.”

Traces of PQQ are found in breast milk, and scientists suggest that it is associated with infant development and healthy growth. However, PQQ is present in the body in extremely low concentrations, so that conventional measurement methods require specialized equipment, such as expensive mass spectrometers. As a result, many aspects of PQQ’s physiological role in breast milk and the mechanisms by which it is transferred into breast milk remain unclear.

To shed light on these mechanisms, the study developed a unique pretreatment method utilizing acetone to efficiently convert PQQ into a compound exhibiting strong fluorescence. This allows for a detection limit of 0.22 nM, even when using a standard HPLC fluorescence detection system.

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Applying this analytical method to human breast milk, concentrations ranging from 1.6 to 57 nM were detected in 51 out of 59 samples. No clear correlation could be established between PQQ concentrations in breast milk and factors such as the mother's age, time of sample collection, or duration of breastfeeding. An analysis of the relationship between PQQ concentrations in breast milk and in plasma also revealed no significant correlation between the two. Generally, it is assumed that blood components are transferred into breast milk in accordance with their concentrations in the blood, so these results suggest that PQQ may be regulated by specific physiological mechanisms, such as uptake, transport, and secretion, within the mammary gland. These new insights may lead to a better understanding of the mechanisms governing the supply of PQQ in breast milk.

MGC is committed to promoting research and development through industry-academia collaboration, with the aim of illuminating the effects of PQQ on infant growth and health maintenance. MGC aims to continue building a body of scientific evidence for functional food ingredients, including "BioPQQ™." By leveraging analytical techniques and insights gained from this research, MGC is strengthening support for product development in the food and nutrition sector, contributing to people's health and improving quality of life.

*1: Microchemical Journal

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- Authors: Naoya Kishikawa, Mahmoud H. El-Maghrabey, Sumire Yokoyama, Narumi Ushijima, Kazuto Ikemoto, Naotaka Kuroda
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