Tetramethoxy azobismethylene quinone (TMAMQ) as a new tool for measuring antioxidant activity

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Abstract

A new antioxidant activity assaying method based on a laccase oxidized syringaldazine product [Tetramethoxy azobismethylene quinone (TMAMQ)] with potential application in food, health and cosmetic industries is reported. TMAMQ was quenched by all known antioxidants tested including dietary simple phenolics and vitamins quenched. The antioxidant activity of phenolics and polyphenolics depended on the position and number of hydroxyl groups on the benzene ring. Equally interesting was the ability of amino acids (cysteine, tryptophan and methionine), cellular and plasma antioxidants (glutathione, albumin, uric acid) to quench TMAMQ, demonstrating the great potential of TMAMQ for analysis of antioxidant activity of clinical samples. The kinetics of the reduction of TMAMQ by pure cellular and plasma antioxidants was studied. The highest reduction rate (*k*) was obtained with ascorbic acid (1.11×10^{-2} $\mu M^{-1}s^{-1}$) while glutathione showed the lowest 2.94×10^{-5} $\mu M^{-1}s^{-1}$. The potential application of TMAMQ to estimate the antioxidant activity of clinical serum samples was compared to a commercially available antioxidant method "Total Antioxidant Capacity" (TAC), and clearly showed a similar trend although the values differ. Further, the ability of TMAMQ to estimate the antioxidant activity of complex food extracts from various food samples also showed varying antioxidant activity with highest for spinach (4.36 mg methanol extract/mmol TMAMQ) followed by kiwi (13.95 mg methanol extract/mmol TMAMQ) and lettuce (40 mg methanol extract/mmol TMAMQ). TMAMQ is a highly sensitive (only a minute plasma sample was required), reproducible and the reaction proceeds until steady state (until all antioxidants have reacted). TMAMQ is very stable in acetonitrile (>3 months), making it a highly flexible method because it can be easily adapted for analysis of just a single sample or for "high-throughput" analysis. This has direct implications on reducing costs and experimental steps. TMAMQ is therefore a highly promising antioxidant activity assay method for food, health and cosmetic industries.