Stabilization and Color Variation of Anthocyanins with Inorganic Salts

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The red, purple and blue colors of flowers, fruits and leaves are mostly anthocyanins. These pigments can be used as safe food colorants, taking the place of synthetic azo-dyes which can contain hepatic toxicity or carcinogenicity. But in neutral media (usual foods indicate pH 4 to 6) anthocyanin first forms purple anhydrobase, but rapidly changes to colorless pseudo base by hydration. Furthermore, it also decolorizes by heating. These properties are major problems in developing its use.

In Japan pigments of leaves of *Perilla ocimoides*, (shiso) are used for coloring salted pickles, such as pickled plum,"umeboshi", and pickled ginger, "benishoga", from long ago. It has been a question why umeboshi keeps such a beautiful red color after several years. Umeboshi is strongly acidic and contains about 20% salt. So salts might be concerned with color stability.

We isolated the pure pigments (malonylshisonin, **1** and shisonin, **2**) from *Perilla* leaves and the obtained pigments were dissolved in various pH's (pH 2 to 8) and concentration's (0 to 4M) salt solutions (NaCl, LiCl, KCl, $MgCl_2$, $AlCl_3$, $FeCl_3$). The stabilities were analyzed by UV-VIS and HPLC.

In acidic aqueous solutions at 80°C, the color of **2** was very stable. In neutral solutions color stability also depended on the concentration of salts. In 4M $MgCl_2$, the color was the deepest of all the used salts. So $MgCl_2$ might strongly prevent the formation of pseudobase. The bathochromic shift of the pigment solutions were observed by addition of $MgCl_2$, $AlCl_3$ and $FeCl_3$. This may be caused by chelation of metal ion at *o*-dihydroxy group of B-ring.

The salts must deeply involve in stability of anthocyanidins. These phenomena may be caused by reducing water activity of the solution, which we are suggested by ^{17}O NMR measurement.