Cyanidin as a potential scavenger of heterocyclic aromatic amines

Monika Romanik-Błońska, Department of Molecular and Cellular Biology, Intercollegiate Faculty of Biotechnology of University of Gdańsk and Medical University of Gdańsk

Supervisor: Jacek Piosik, PhD

Raspberry (*Rubus ideaus*) fruits are the source of many anthocynins derivatives, with the most common cyanidin 3-*O*-sophoroside. Its aglycone form – cyanidin – is a non-toxic, small molecule with a high antioxidant properties and potential to form stacking (π-π) complexes. It was analyzed in many research projects and found to possess lots of beneficial functions such as scavenging activity against free radicals, anticancerogenic properties, ability to prevent inflammation and antimutagenic activity. What is more, cyanidin molecules can interact non-covalently with other anthocyanins in a process called copigmentation.

It is hypothesized that cyanidin can also act as an interceptor molecule, sequestering aromatic mutagens in stacking (π-π) complexes and in this way decreasing their bioavailability and, in consequence, mutagenic activity. To verify this hypothesis a group of seven representatives of heterocyclic aromatic amines (HCAs) – food-derived mutagens – was chosen. They are called 2-amino-3-methylimidazo[4,5-f]quinoline (IQ)-type HCAs and occur mostly in cooked meat. IQ-type HCAs are produced in high temperature (above 150°C), when pyridine or pyrazines (heat-catalyzed degradation products of amino acids) and monosaccharides react with creatine. They can interact with DNA (exactly with deoxyguanosine), forming adducts that induce mutations and in this way leading to cancer development.

In order to assess the ability of the cyanidin solution to interact with HCAs, a UV-Vis spectrophotometric measurements, followed by calculations using appropriate thermodynamical model of mixed aggregation, were performed. To analyze the influence of cyanidin on the mutagenic activity of HCAs, bacterial mutagenicity Ames tests based on *Salmonella typhimurium* TA98 strain were also carried out. Additionally, Autodock Vina docking procedure was used to receive sets of low-energy HCAs/cyanidin complexes. Results obtained from the biophysical experiments suggest that cyanidin molecules can form mixed stacking complexes with IQ-type HCAs. What is more, this phenomenon can decrease the mutagenic activity of HCAs – in the mutagenicity Ames tests the effective concentration of cyanidin was the same or maximally 2-fold higher than the concentration of added mutagen, depending on the type of HCAs. Additionally, the most probable structures of HCAs/cyanidin complexes and total free energy of complex formation values calculated during Autodock Vina docking procedure also conform HCAs/cyanidin direct interactions.

KSZTAŁCIMY NAJLEPSZYCH *– kompleksowy program rozwoju doktorantów, młodych doktorów oraz akademickiej kadry dydaktycznej Uniwersytetu Gdańskiego. Zad. 2. Life Sciences and Mathematics Interdisciplinary Doctoral Studies (LiSMIDoS)*

HUMAN CAPITAL
NATIONAL COHESION STRATEGY

EUROPEAN UNION
EUROPEAN
SOCIAL FUND

Project co-funded by European Union under the European Social Fund