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Could we use antioxidants to produce foods with low acrylamide content?

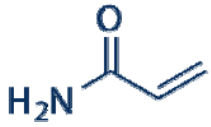
Banu AKGÜN [1*], ***Nurcan AYŞAR GÜZELSOY***[1], ***Filiz ÇAVUŞ***[1]
[1]*Central Research Institute of Food and Feed Control, Bursa, Turkey*
**Corresponding Author: banu.akgun@tarimorman.gov.tr*

INTRODUCTION

In 2002, researchers found that many heat-treated foods contain a considerable amount of toxic chemical called acrylamide. In terms of acrylamide levels, potato chips, french fries coffee products, bakery products and cornflakes are leading food products. Due to toxic effects of acrylamide, Food Safety Authorities suggest that the amount of acrylamide in these food products should be mitigated by applying different strategies. These strategies could be changing process conditions, selecting raw material with low asparagine and sugar content or aplying pre-teatments (such as blanching and soaking). However, these strategies may both impact the acrylamide and desirable Maillard reaction product formation. Thus, it is important to find a way to reduce acrylamide content of food products without negatively affecting its sensorial and quality properties. In recent years, the protective role of antioxidants have been examined against acrylamide formation in heat-treated foods.

How may antioxidants reduce acrylamide?

Antioxidants may decrease acrylamide levels in foods by 3 ways as stated below (Gray, 2010; Ibrahim et al., 2019):
1) Destroying formed acrylamide by their oxidised products,
2) Inhibiting carbonyl compounds production,
3) The formation of carbonyl compounds that may react with the asparagines (acrylamide precursor).



Acrylamide (Selleckchem.com)

Past studies

***Wang et al. (2013) investigated the effect of phytic acid that is a natural plant antioxidant on acrylamide formation. They found that the phytic acid may promote Maillard reaction and acrylamide formation.**
***Zhu et al. (2009) used plant extracts to reduce acrylamide in an asparagine/glucose model system. They found that the greatest reductions were obtained with extracts of mint, cumin seeds and star anise. *p*-coumaric acid led to the highest reduction (53%), whereas hesperetin rose acrylamide level (9%).**
***Bassama et al. (2010) tested the effect of cinnamic acid and six phenolic compounds (gallic, ferulic, coumaric, caffeic acids, catechin, and epicatechin) on acrylamide formation in an equimolar asparagine–glucose system (10 mM) during heating (200 °C). They reported that tested compounds could not manage to decrease acrylamide level. However, slight promotion was obtained in ferulic acid.**
***Kotsiou et al. (2010) investigated the effect of tyrosol, oleuropein and p-hydroxyphenylacetic acid on acrylamide formation. In the model system, they obtained acrylamide reduction up to %50.**
***Zhu et al. (2011) found that the extracts of clove reduced the level of acrylamide (%50.9) in cookies and the addition of 2% proanthocyanidins from grape seeds decreased the acrylamide amount (62.2%) in a starch-based model system.**
***Yuan et al. (2011) managed to reduce the acrylamide level (more than 50%) in asparagine/fructose model by using allicin. An antioxidant compund allicin is found in garlic.**
***Abdel-Monem et al. (2013) reduced acrylamide content of potato chips by pre-soaking with different phenolic extracts containing ferulic acid, protocatechoic acid, caffeic acid, catechin or gallic acid.**

Conclusion

The impact of antioxidants on acrylamide has not been yet clarified adequately. In some studies, arylamide level decreased, increased or did not change. It can be related to the ability of antioxidants with different structures to react with acrylamide precursors. Also, the same kind of antioxidant may behave differently in various studies owing to distinct reaction conditions, concentrations of the extract and preparation methods of the extract. Hence, more studies should be done to understand better the effect of antioxidants on acrylamide formation.

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