

## Selecting Natural Antioxidants for Snack Foods

Authors: Jessica Cusovich, Madalina Mocanita, Andrew Evans & John Craven

### Introduction

The choice of antioxidant is influenced by many factors (e.g. processing conditions, fatty acid composition, product matrix). Here we demonstrate that, because of these factors, the best antioxidant system for extending shelf life in the base oil may not be the best choice for a food product made with that oil.

### Materials and Methods

The efficacy of 5 antioxidant solutions (see Table 1) in 3 common base oils (canola, high- and mid-oleic sunflower) and in 3 popular snack foods prepared with those oils was compared. Induction time was measured by Oxidative Stability Index (for base oils) and Oxygen Bomb (for snack foods).

**Table 1 Antioxidant solutions**

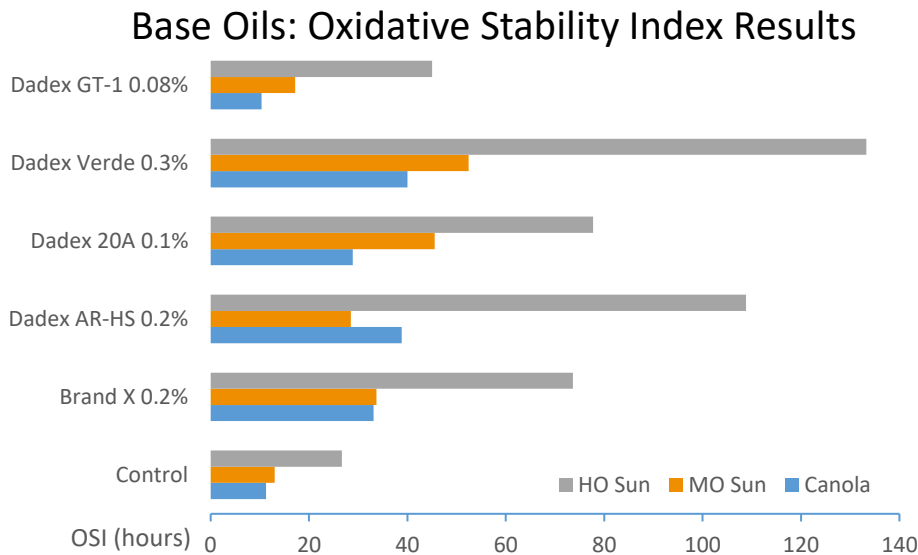
ID	Active Ingredients
Dadex GT-1	Mixed tocopherols
Dadex Verde	Green tea extract
Dadex 20A	TBHQ
Dadex AR-HS	Rosemary extract, Ascorbic acid
Brand X	Rosemary extract, Ascorbic acid

Three snack foods were prepared using the base oils containing antioxidant solutions (see inset). Each of these snack foods differs in terms of ingredients, preparation, physical structure and thermal treatment.

 <p><b>Granola bar</b>            Ingredients: rolled oats, oat flour, honey, sugar, <b>oil (11.3%)</b>, vanilla flavor, sodium bicarbonate, salt            Baked 166°C for 15 minutes</p>	 <p><b>Popcorn</b>            Ingredients: popcorn kernels, <b>oil (17%)</b>, salt            Heated in oil ~180°C for 3 minutes</p>	 <p><b>Potato chips</b>            Ingredients: potato, <b>oil (~40%)</b>, salt            Deep fried 170°C for 4 minutes</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## Results and Discussion

Induction time for the 3 oils with 5 different antioxidant solutions and a control are compared in Figure 1.

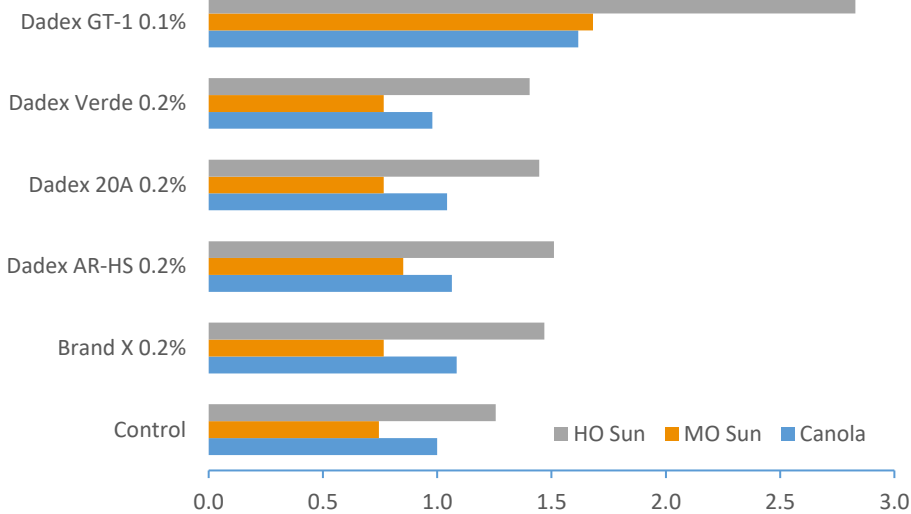


**Figure 1** Oxidative Stability Index (OSI) for base oils containing antioxidants measured using an OSI 8 (Omnion-Agilent) set to 110°C. Results were analyzed using the dedicated software (National Instruments Labview 2012, version 12.0.01f3).

As expected, high-oleic sunflower oil had the longest induction time, canola oil the shortest, and mid-oleic sunflower oil was in between (with one exception). Antioxidants containing green tea or rosemary extract (Dadex Verde and AR-HS) performed the best in these base oils.

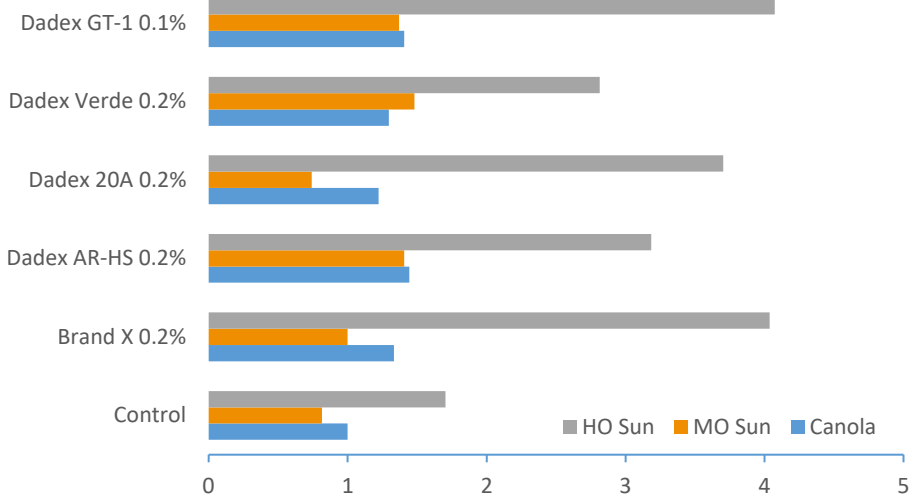
Induction time for 3 snack foods made using 3 base oils dosed with 5 different antioxidant solutions and control samples are compared in Figures 2 – 4. Based on results from the base oils (Figure 1), it is surprising that mixed tocopherol (Dadex GT-1) performed so well in both the granola bar and popcorn. This illustrates the importance of food matrix and processing conditions. In addition, mixed tocopherol is a good choice for potato chips because it is less prone to thermal degradation than the other choices presented here (details in caption below Figure 4).

### Granola Bars: Normalized OxiPres Results



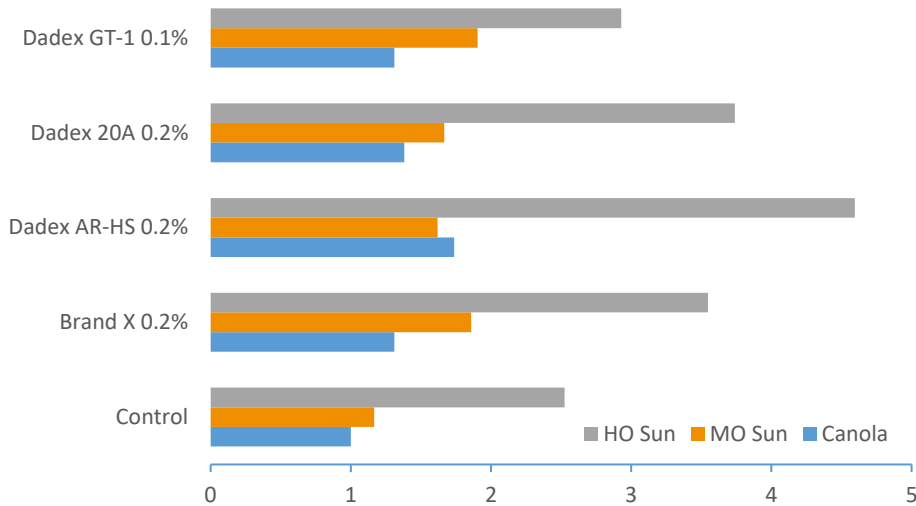
**Figure 2** Normalized data for determining induction time using the OxiPres (Mikrolab Aarhus) set to 100°C. Results were analyzed using the dedicated Paralog software (version 3.10). Interestingly, canola oil offers better shelf-life stability than mid-oleic sunflower oil for the conditions tested.

### Popcorn: Normalized OxiPres Results



**Figure 3** Normalized data for determining induction time as measured for Figure 2.

## Potato Chips: Normalized OxiPres Results



**Figure 4** Normalized data for determining induction time as measured for Figure 2. Dadex Verde (green tea extract) is not suitable for frying applications because it changes colour (pink). Carnosic acid in rosemary extract (Dadex AR-HS and Brand X) and TBHQ (Dadex 20A) all degrade with heat. Dadex GT-1 (mixed tocopherol) is more resistant to thermal degradation and is the best choice for long-term deep frying applications (Miyagawa et al., 1991).

### Conclusions

- ❖ Best choice of oil and antioxidant system is very product-specific (depends on product matrix, fatty acid profile, process conditions)
  - For example, mixed tocopherol (Dadex GT-1) excels in granola bar and popcorn but was not the top performer in base oil
- ❖ In all cases, at least one natural antioxidant outperformed the synthetic option (Dadex 20A, TBHQ)

### References

Miyagawa, K, K Hirai and R Takezoe (1991) JAOCS (68)163-166  
 AOCS Official Methods Cd 12b-92 for Oxidative Stability Index and Cd 12c-16 for Oxygen Bomb