Seabuckthorn (*Hippophaë Rhamnoides L.*) Powders Obtained by Hot-air or Freeze-drying

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OUTLINE

- **Introduction**

  Fonctional food powder, Drying methods, Challenges in sea buckthorn powder production

- **Objectives**

- **Materials & Methods**

- **Results & Discussion**

- **Conclusions**

Functional Food Powders

A solid **dry** food in the form of tiny loose particles designed to provide a specific and beneficial physiological effect on health, performance and/or well-being extending **beyond** the provision of simple nutrients

powder

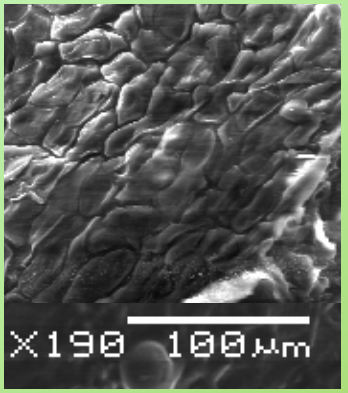
functional

INITIAL QUALITY —concentration→ FINAL QUALITY

Drying Methods

HOT-AIR DRYING

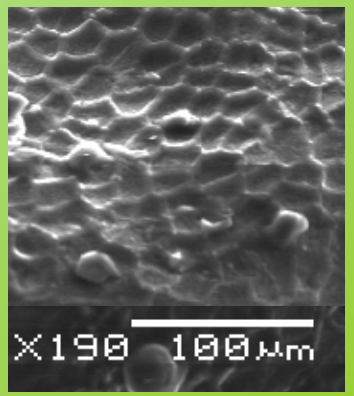
- *Low cost*
- *Oxygen, high temperature*
- *Evaporation*
- *Parabolic moisture profile*
- *Shrinkage*
- *Compact, destroyed structure*



(Gutierrez et al., 2007)

FREEZE-DRYING

- *High cost*
- *Vacuum, low temperature*
- *Sublimation*
- *Receding front*
- *Small volume change*
- *Porous & well organized structure*



(Gutierrez et al., 2007)

Sea Buckthorn Powder Challenges

- Skin problems → hard to dry

- Keep outstanding initial quality after drying

- Stability during storage

OBJECTIVES

1 – To study the production of seabuckthorn powders by hot-air and freeze-drying processes.

2 – To analyze the retention of the nutritional seabuckthorn quality after hot-air and freeze-drying.

3 – To predict the storage conditions (RH and temperature) necessary to maintain stability of seabuckthorn powders.

MATERIALS & METHODS

var. Indian Summer

FRUITS

halved and grain extraction

Initial Characterization

T = 50, 60ºC
v = 1 m/sec

AIR DRYING

FREEZE-DRYING

T = 20, 50ºC
P = 30 mTorr

POWDER

Stability

Final Characterization

- Sorption isotherms
- Glass transition temperature

- Nutritional
- Visual

Analytical Methods

pH, Acidity, Soluble Solids

Vitamin C

According to the method described in Askar and Treptow (1993).

Vitamin E

Extraction: Yang and Khallio (2002); analysis by GC/MS (Pascal Dubé, 2006)

Carotenoids and Phenolics

According to the method described in Gao et al. (2000).

Sorption Isotherms

300 mg were placed in desiccators over saturated salt solutions (LiCl, NaCl, NaBr, KCl, $MgCl_2$, CH_3COOK) at constant temperature (20°C).

Glass Transition Temperature

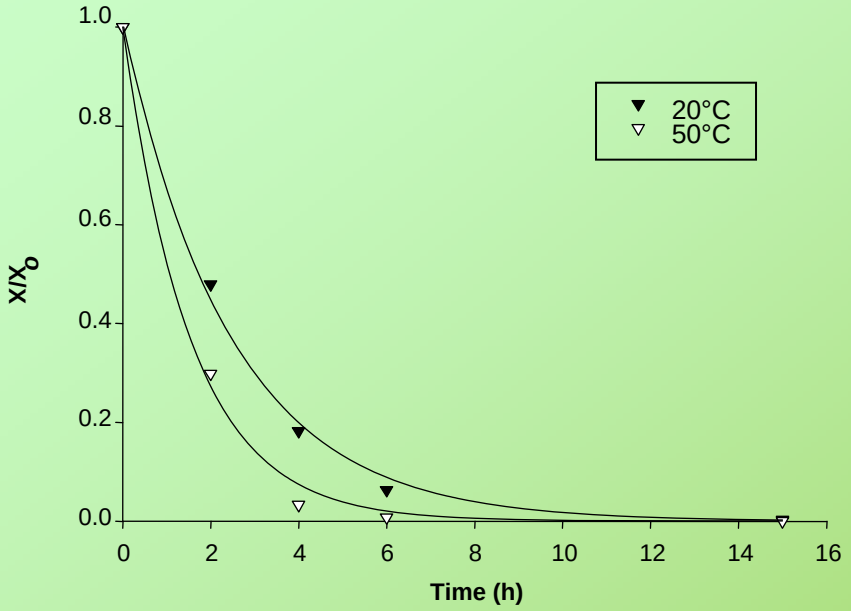
Differential Scanning Calorimeter (DSC Model Pyris 1, Perkin Elmer, Boston, MA, USA)

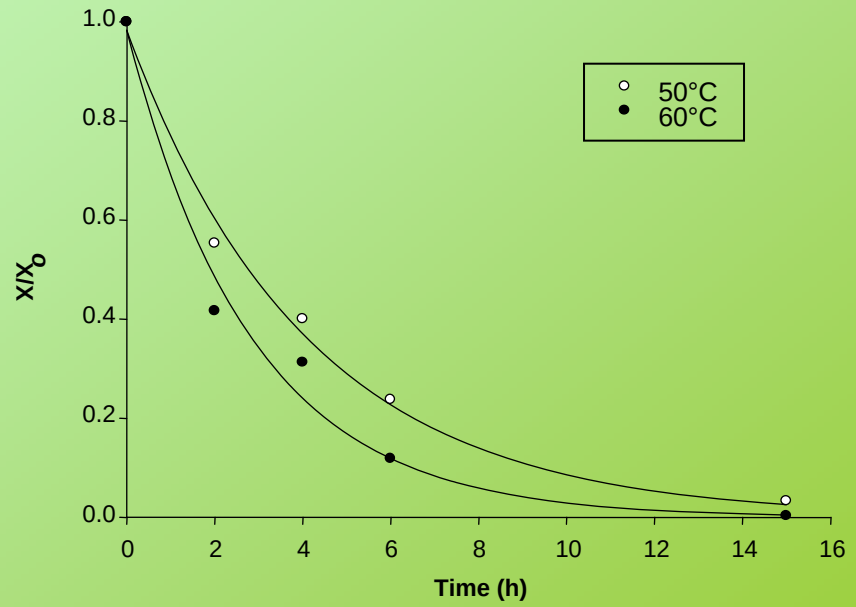
RESULTS & DISCUSSION

Fresh Seabuckthorn

	Seabuckthorn harvested on 17/08/2006	Literature values	Reference
pH	**2.57 ± 0.03**	3.20 ± 0.02	Beveridge et al., 2002
Soluble Solids (^{o}Brix)	**7.91 ± 0.57**	9.3-17.3	Beveridge et al., 2002
Acidity (% malic acid)	**1.71 ± 0.04**	1.86 ± 0.23	Beveridge et al., 2002
Vitamin C (mg / 100g)	**184.6 ± 23.2**	174.7 ± 30.7	Beveridge et al., 2002
Vitamin E (mg / 100g)	**10.8± 0.4**	1 to 15	Yang et Kallio, 2002
Total Phenolics (mg / 100g)	**373.3 ± 28.3**	187.9 to 244.1	Gao et al., 2000
Carotenoids (mg / 100g)	**3.99 ± 0.14**	1 to 6.5	Gao et al., 2000

Drying Kinetics





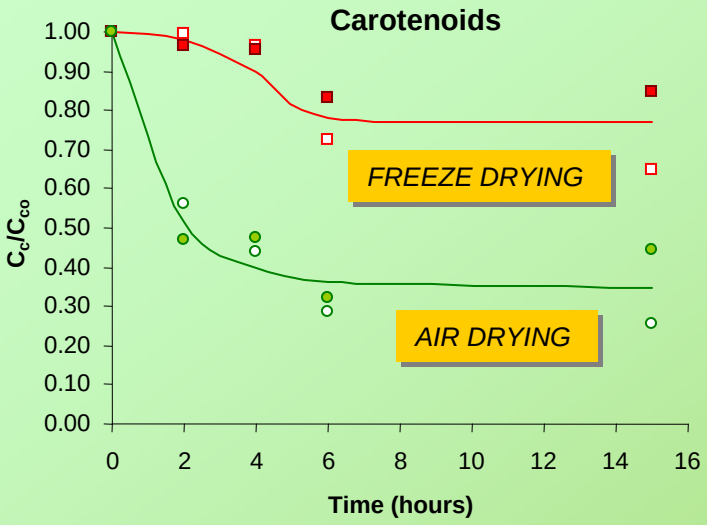
Freeze-Drying

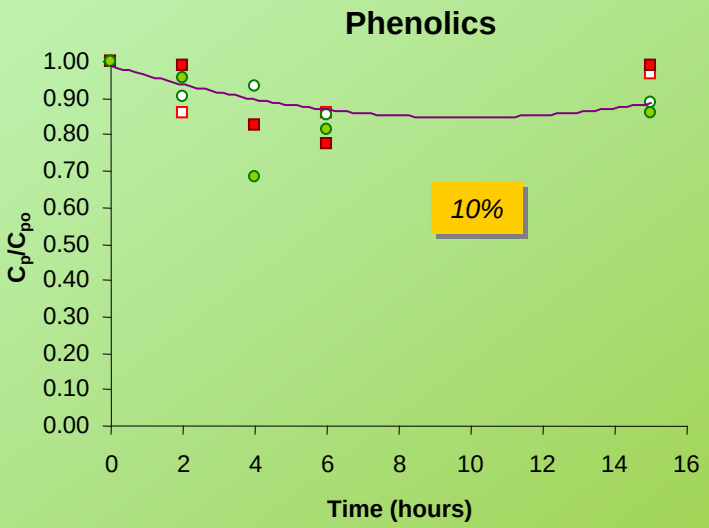
20°C → 10-12 hours
50°C → 6 hours

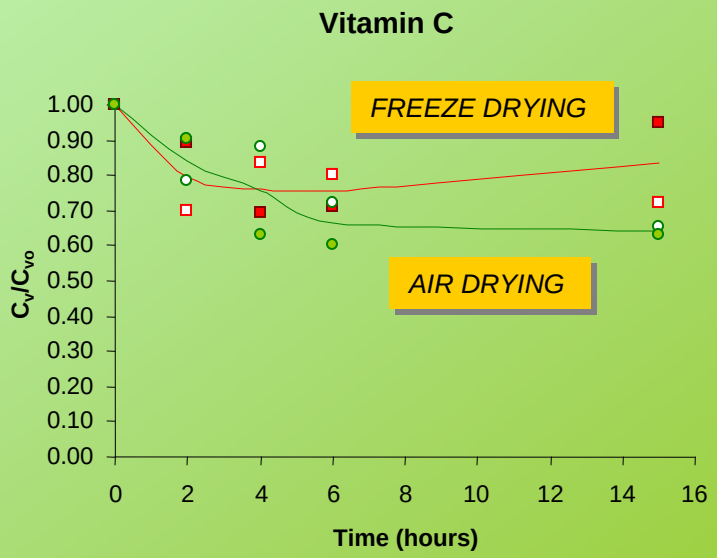
Hot Air-Drying

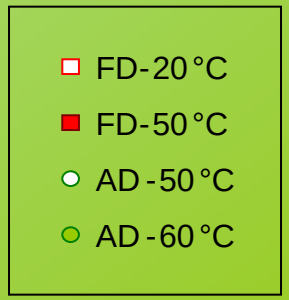
50°C → 16-18 hours
60°C → 14 hours

Nutritional Quality







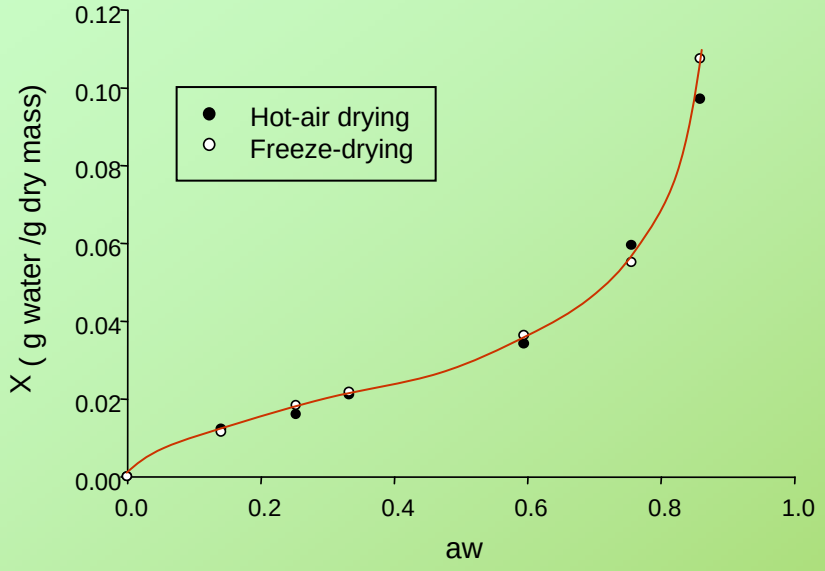


Seabuckthorn Powders

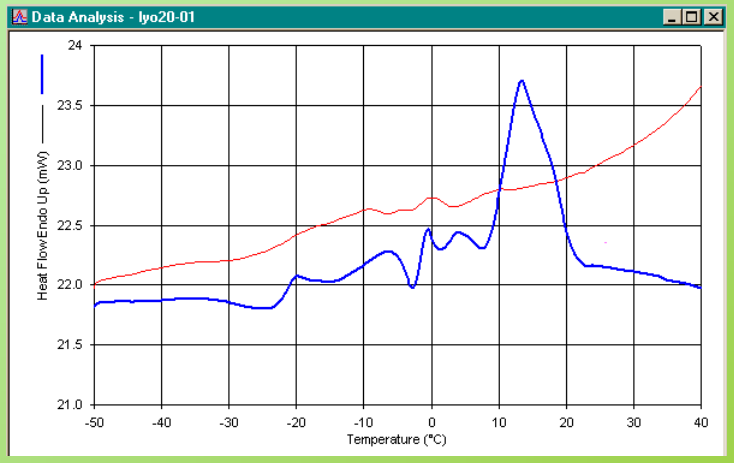
AIR DRYING → *impossible to make a powder (tiny loose particles)*

FREEZE-DRYING → *possible depending on the mechanical pretreatment*

Storage Stability



SORPTION ISOTHERM



GLASS TRANSITION TEMPERATURE

CONCLUSIONS

1 – It is possible to make a powder out of Seabuckthorn by freeze-drying depending on the mechanical pretreatment.

2 – Seabuckthorn freeze-drying kinetics is much faster than air-drying (at 50^{o}C just 6 hours are needed for obtain a dry product).

3 – Freeze-drying keeps double amount of carotenoids (80 to 40%), 10% more vitamin C and the same amount of phenolics than air drying.

4 – Seabuckthorn dry product is hygroscopic.

ACKNOWLEDGEMENTS

- NSERC

- Association des producteurs d’argousier du Québec (M. André Nicole)

- Ann-Julie Duguay

- Marie-Claude Verreault

- Pascal Dubé