universidade de aveiro

path

http://path.web.ua.pt

Estudo de novos materiais de mudança de fase

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Orientador: João A. P. Coutinho

Mestrado de Materiais Derivados de Recursos Renováveis

Resumo

1. Introdução

2. Estudo da aplicação de PCMs parafínicos ao isolamento térmico
    - Protótipos

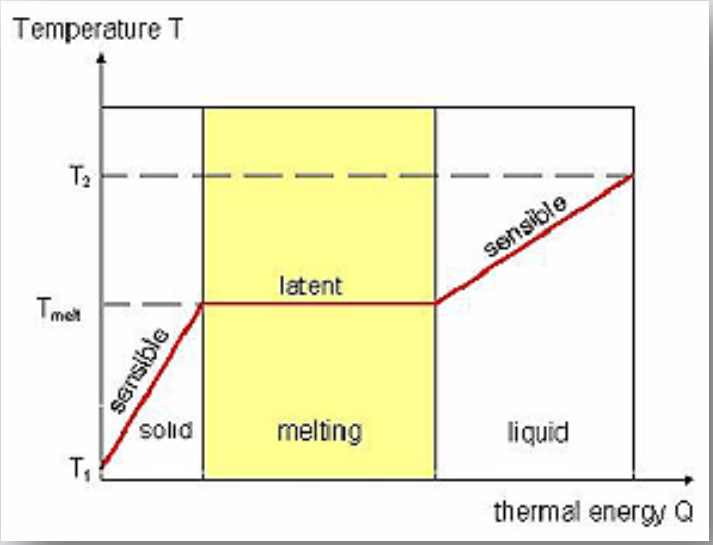
3. Desenvolvimento de novos PCMs
    - Extracção de ésteres do biodiesel
    - Análise composicional do biodiesel
    - DSC
    - Diagramas de fase de esteres de ácidos gordos

4. Conclusões finais e trabalho futuro

1. Introdução

▸ PCMs – Materiais de mudança de fase

Os compostos de mudança de fase (PCMs) possuem um elevado calor de fusão e por essa razão são capazes de absorver uma grande quantidade de energia durante a sua fusão, mantendo-se a uma temperatura constante durante a mudança de fase.



1. Introdução

▸ PCMs – Materiais de mudança de fase

- Elevado calor latente
- Elevada condutividade térmica
- Temperatura de fusão numa região operacional
- Estável quimicamente
- Baixo custo
- Não tóxico e não corrosivo

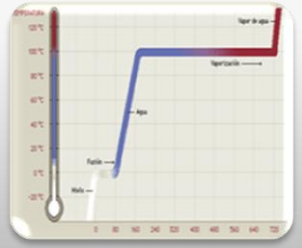
1. Introdução

Climatização de edifícios

- aquecimento
- arrefecimento

Problemas

- Custo
- Consumo de energia
- Emissão de CO2

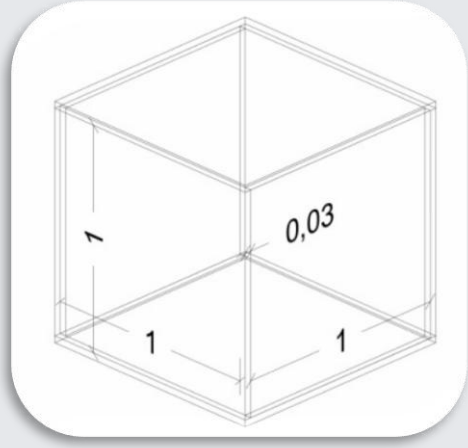


Solução

- Materiais com propriedades de armazenamento de energia
- PCMs devidos ao seu elevado calor latente de fusão

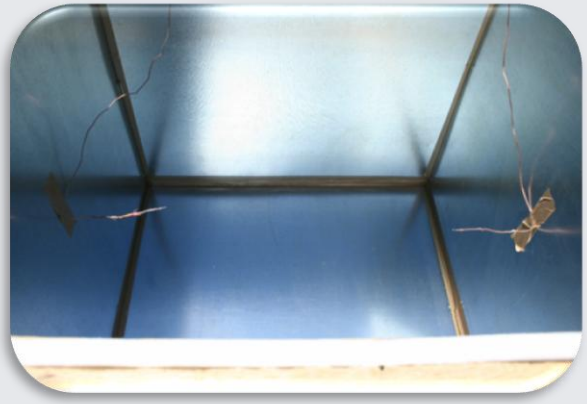
2. PCMs parafínicos

- Protótipos



- Localização

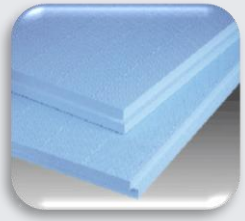
- Termopares



2. PCMs parafínicos

▸ Protótipos

Cubo 1



Wallmate
(poliestireno extrudido)

Cubo 2

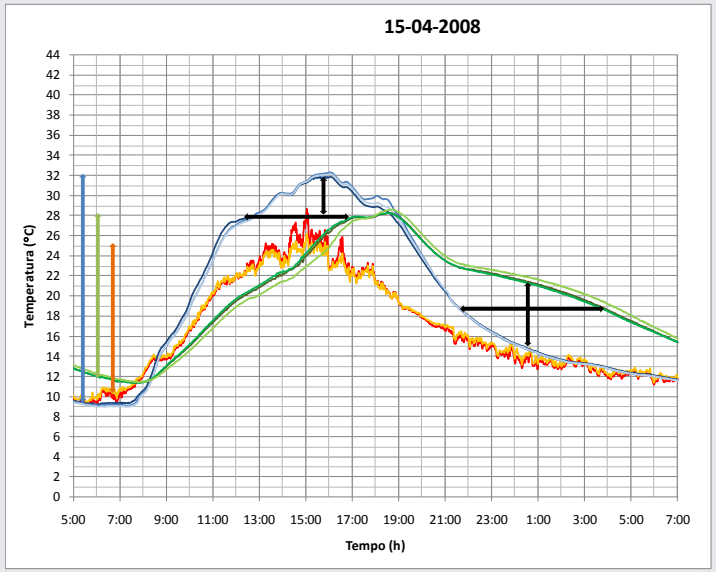
Granulado de cortiça

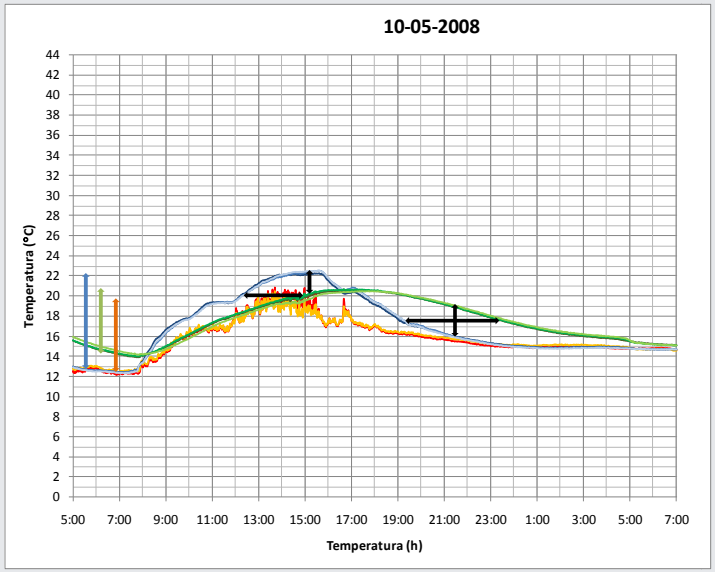
Cubo 3

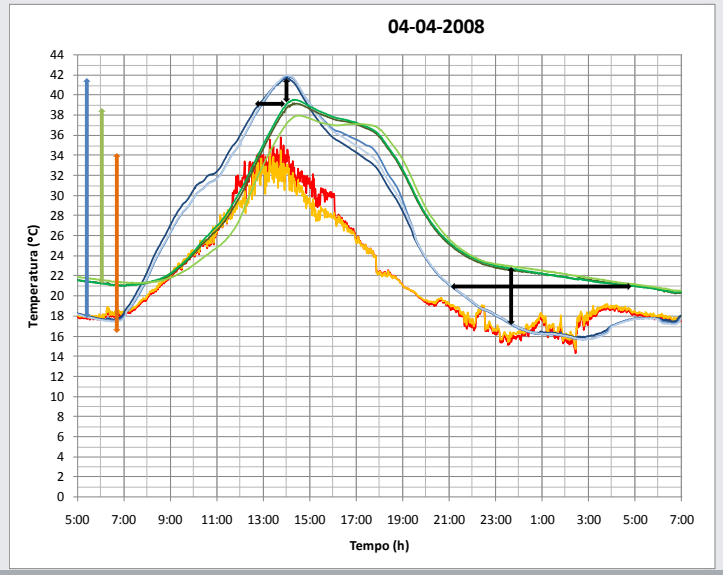
Granulado de cortiça

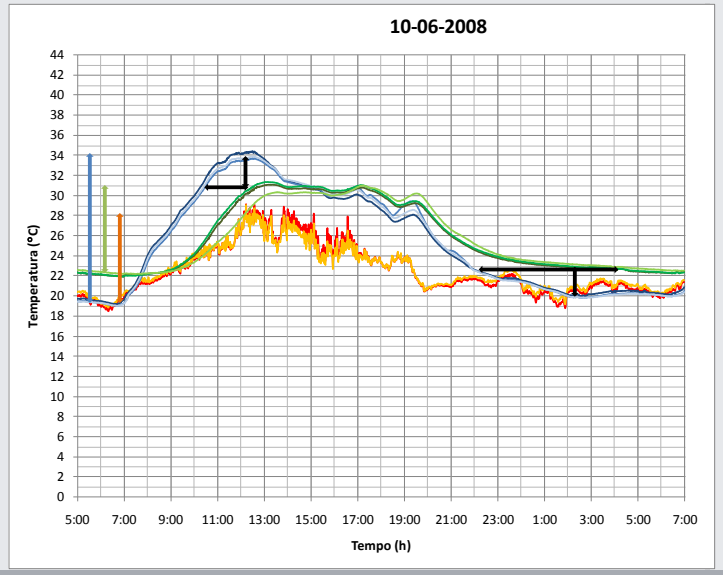
PCM RT20

2. PCMs parafínicos



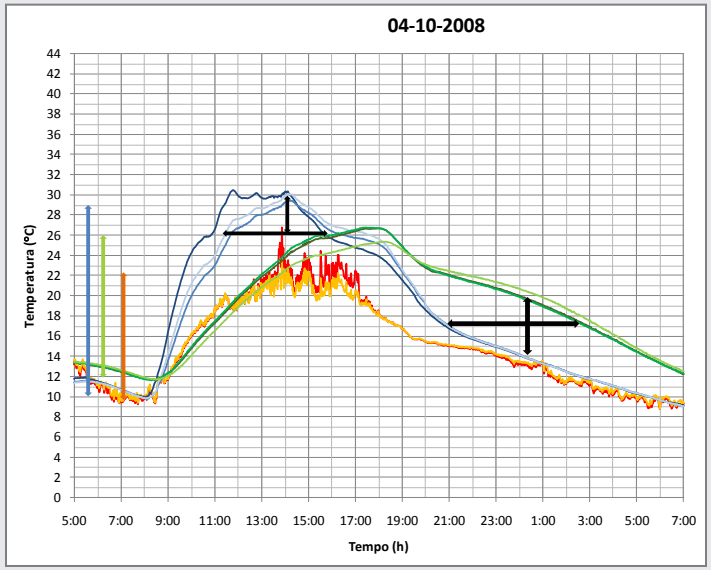


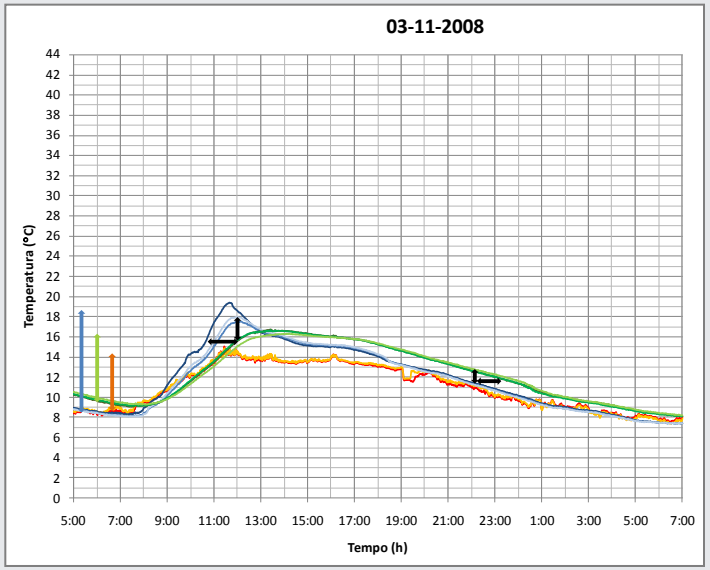


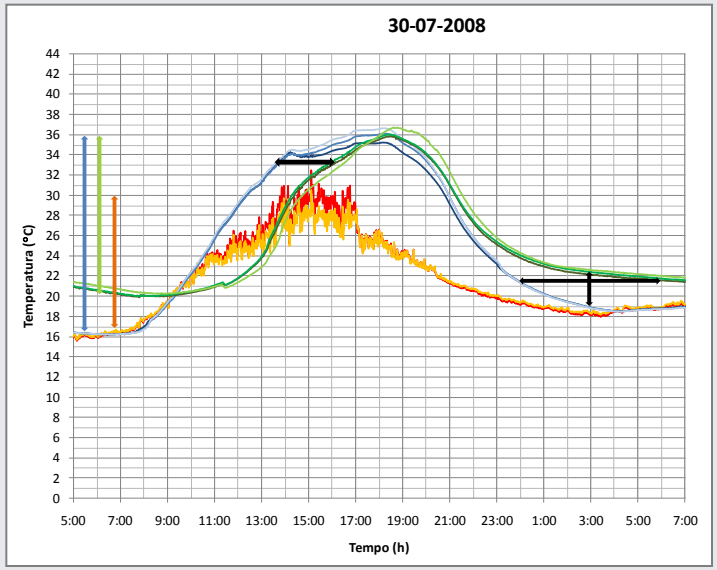


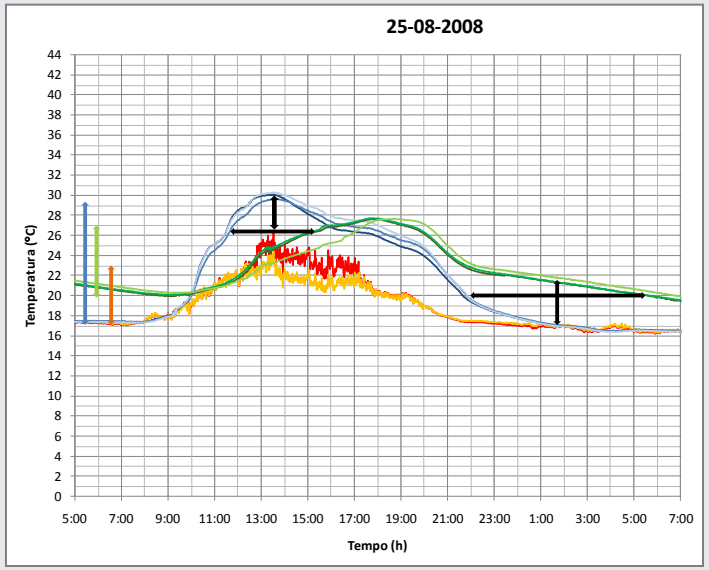
- Ambiente 1
- Ambiente 2
- XPS (SE)
- XPS (NW)
- XPS (meio)
- Cortiça/RT20 (NW)
- Cortiça/RT20 (meio)
- Cortiça/RT20 (SE)

2. PCMs parafínicos









- Ambiente 1
- Ambiente 2
- Cortiça (SE)
- Cortiça (NW)
- Cortiça (meio)
- Cortiça/RT20 (NW)
- Cortiça/RT20 (meio)
- Cortiça/RT20 (SE)

3. PCMs do biodiesel

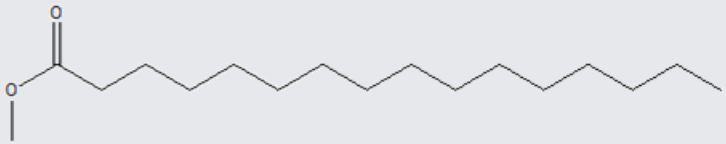
Ésteres Metílicos

- Fonte renovável
- Custo - Indústria paralela à do biodiesel
- Possível excedente de produção de biodiesel

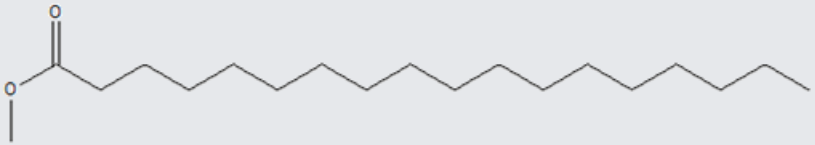
PCM parafínicos

- Variação de temperaturas de fusão entre -3 e 100ºC

▸ Ésteres metílicos saturados

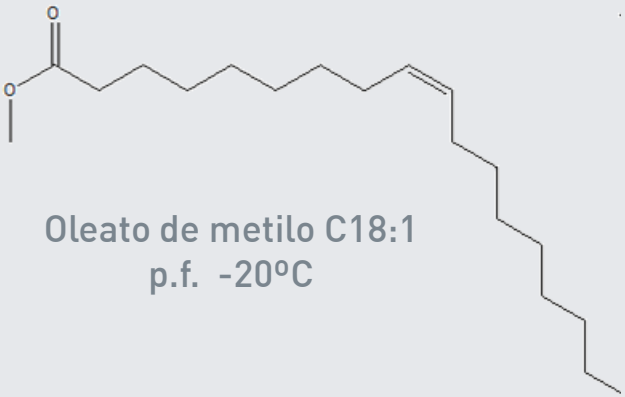


Palmitato de metilo C16:0
p.f. 30,5 °C

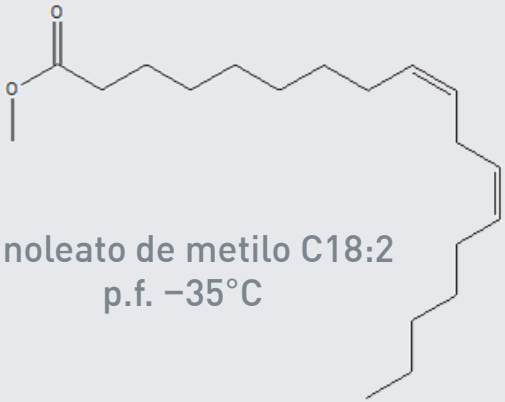


Estearato de metilo C18:0
p.f. 39,1 °C

▸ Ésteres metílicos insaturados



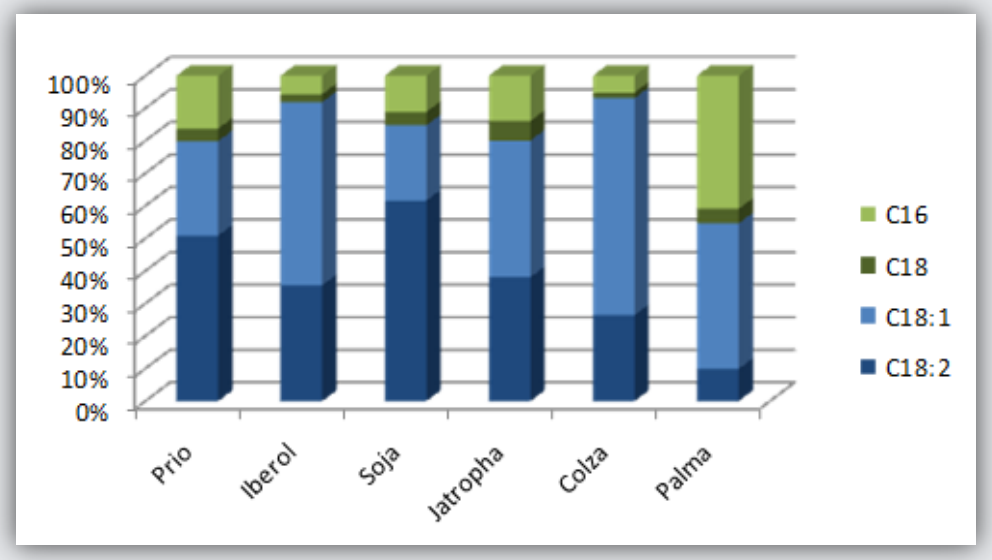
Oleato de metilo C18:1
p.f. -20ºC



Linoleato de metilo C18:2
p.f. −35°C

3. Biodiesel

▸ Composição



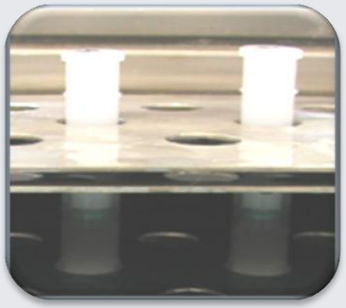
Biodiesel	CP (°C)	
	visual	DSC
Prio	1,40	6,41
Iberol	-2,25	-2,58
Jatropha	11,43	2,16
Soja	7,20	1,93
Palma	18,46	16,41
Colza	-6,26	-8,50

IBEROL

prio advanced fuels

3. Extracção de SFAMEs do biodiesel

- Procedimento

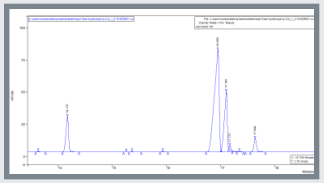


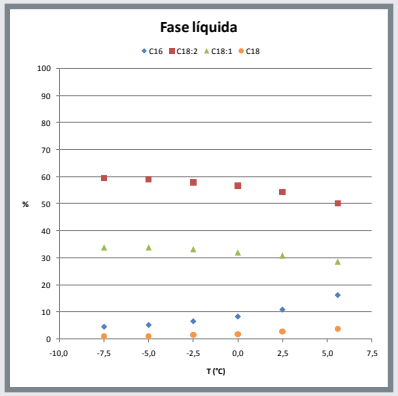
24h

3. Extracção de SFAMEs do biodiesel

Fase líquida

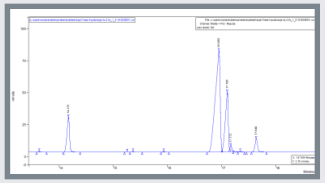
GC-FID





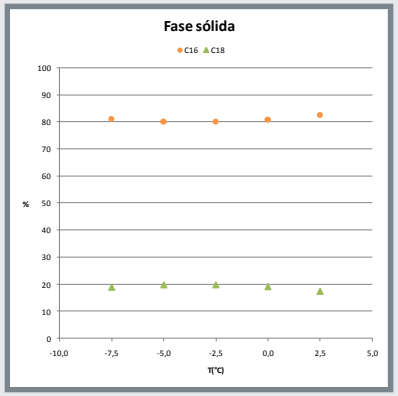
Precipitado
(fase sólida + fase líquida)

GC-FID



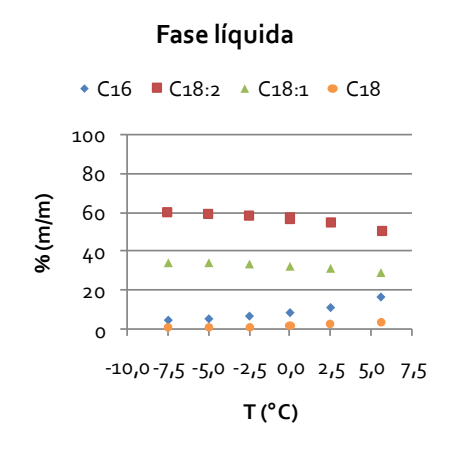
$$X_i^S = \frac{X_i^P - cX_i^L}{1 - c}$$

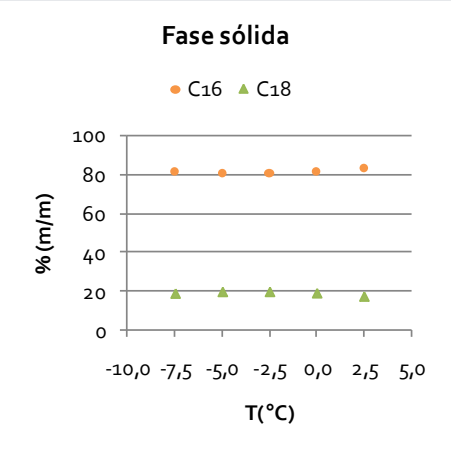
$$c = \frac{X_{C18:1}^P + X_{C18:2}^P}{X_{C18:1}^L + X_{c18:2}^L}$$



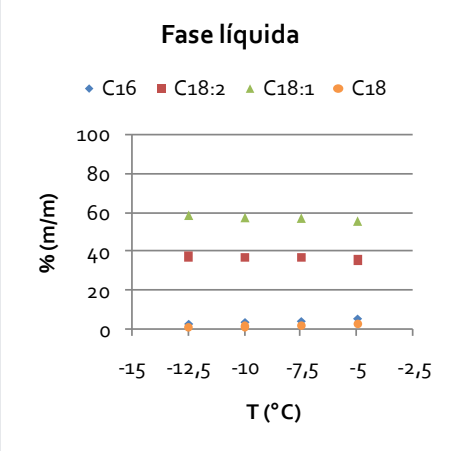
3. Extracção de SFAMEs do biodiesel

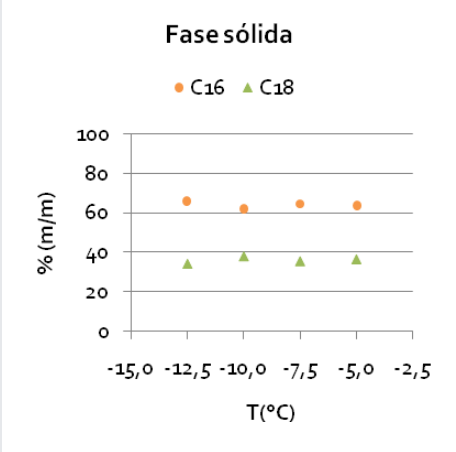
Prio



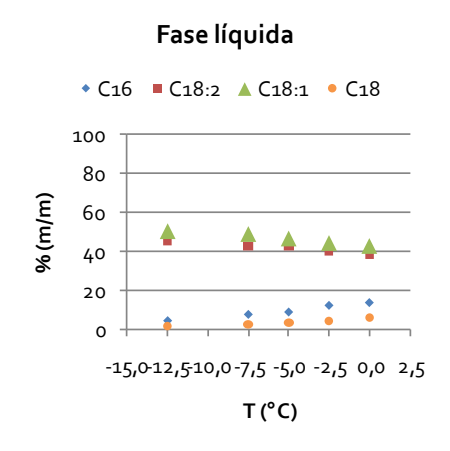


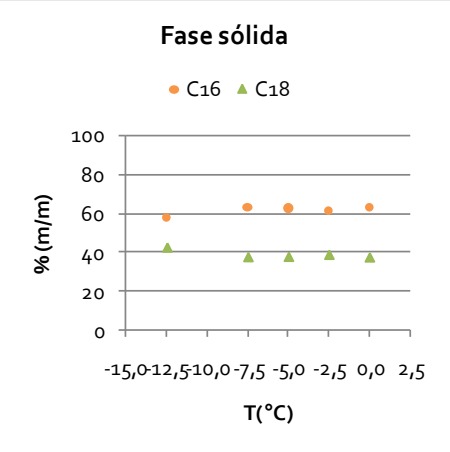
Iberol



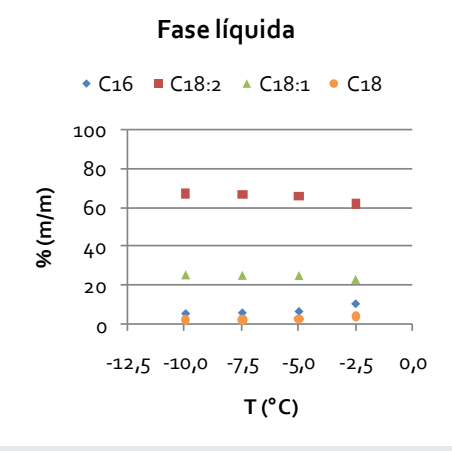


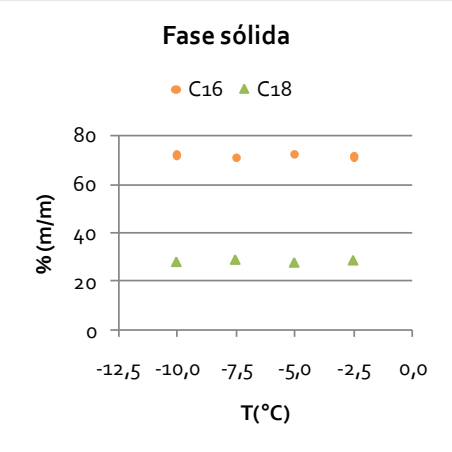
Jatropha





Soja

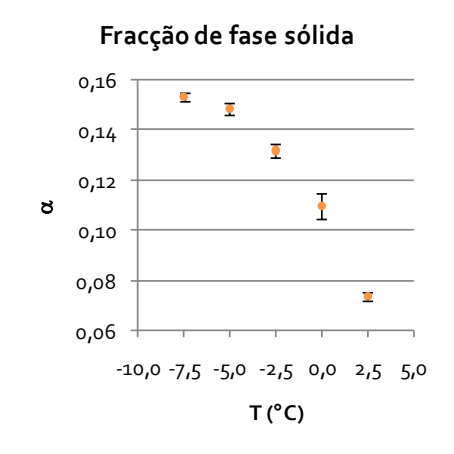




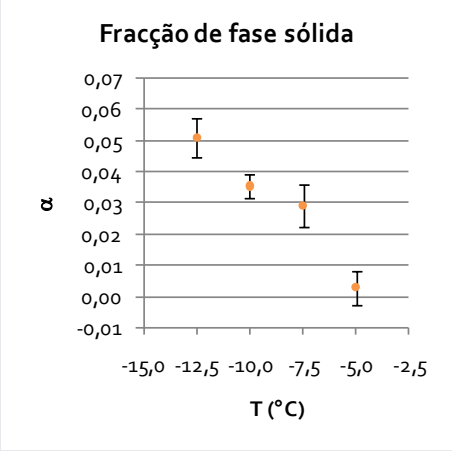
3. Extracção de SFAMEs do biodiesel

$$\alpha = \frac{X^0 - X^L}{X^S - X^L}$$

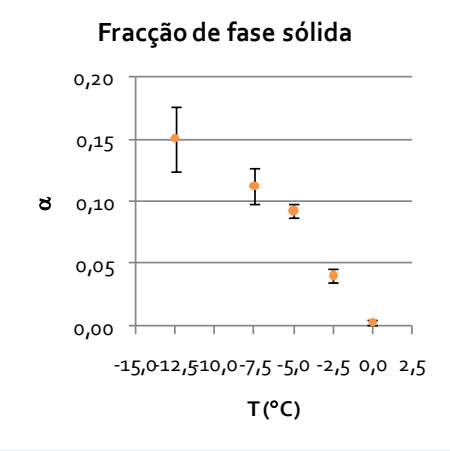
Prio



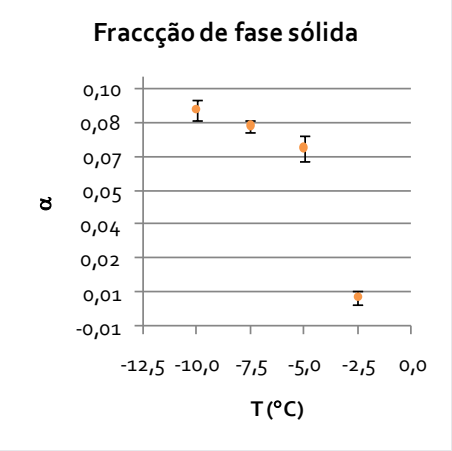
Iberol



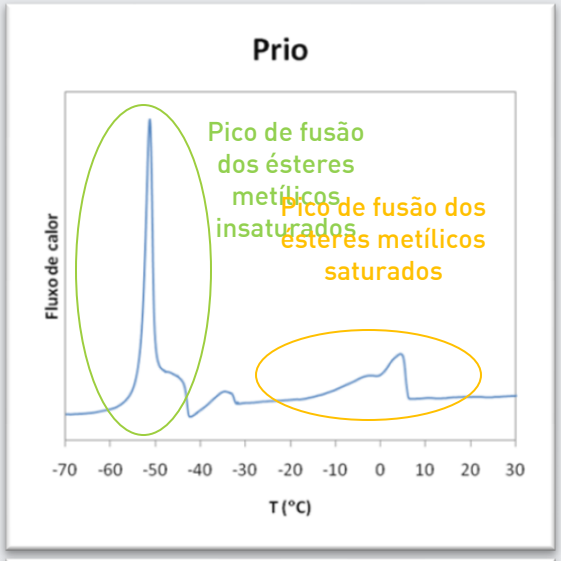
Jatropha

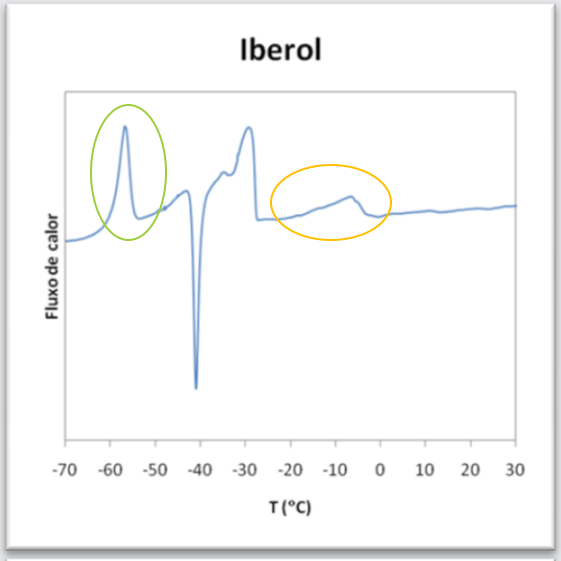


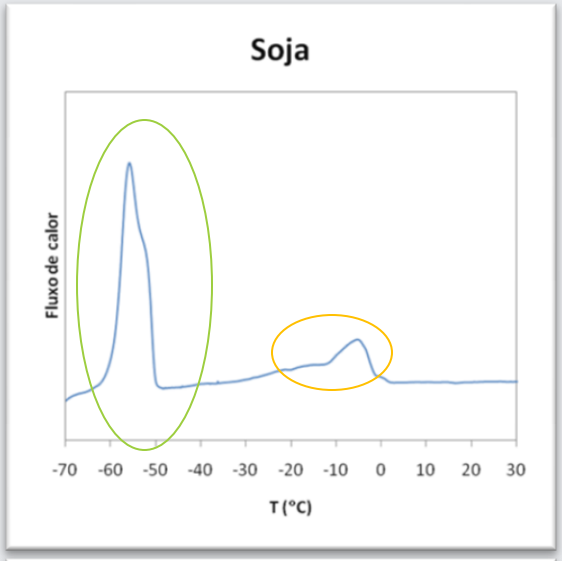
Soja

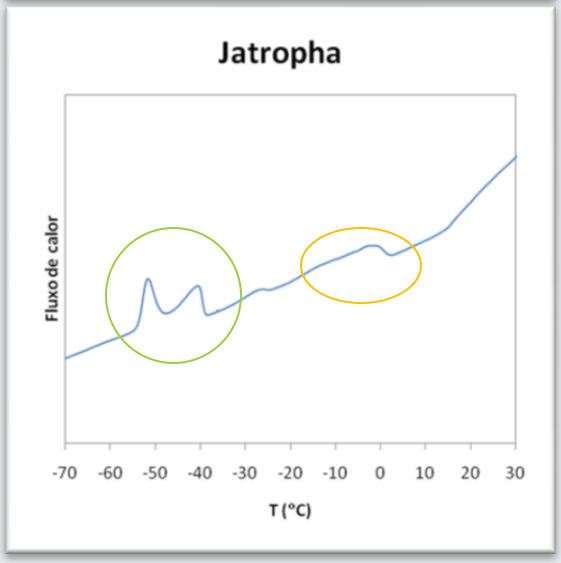


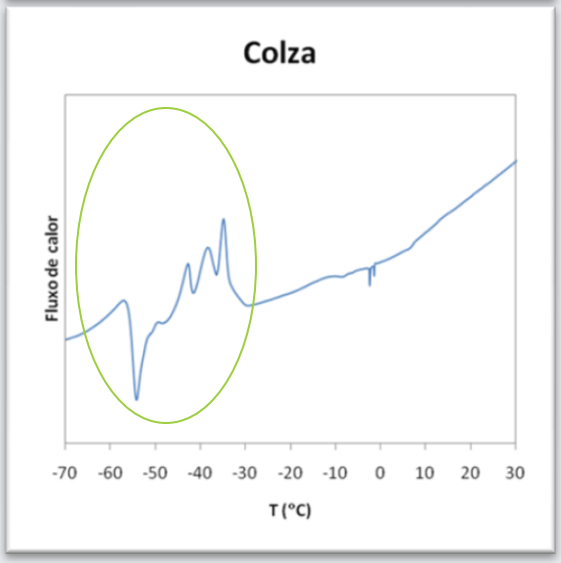
3. DSC

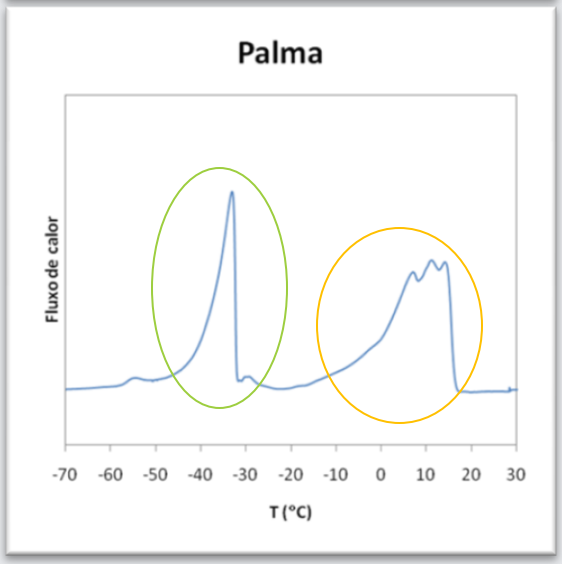

Prio
Pico de fusão dos ésteres metílicos insaturados
Pico de fusão dos ésteres metílicos saturados
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)


Iberol
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)

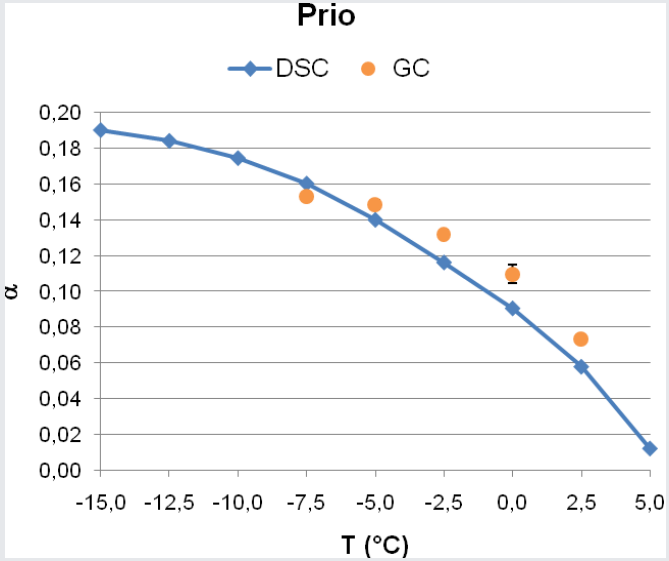

Soja
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)

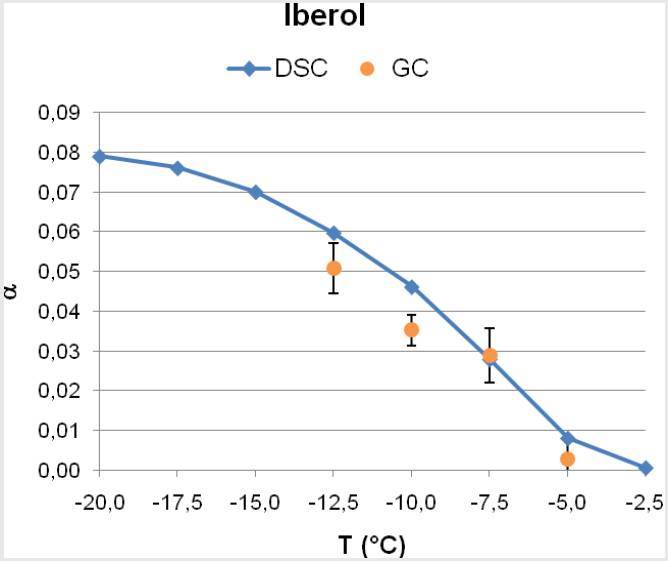

Jatropha
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)

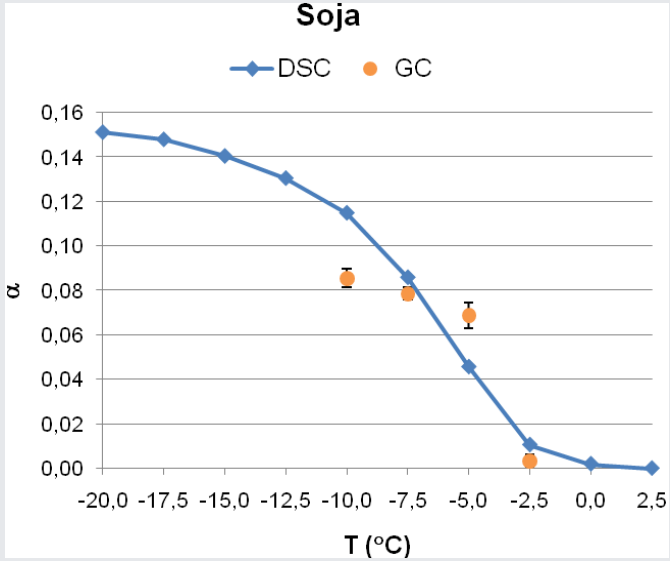

Colza
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)

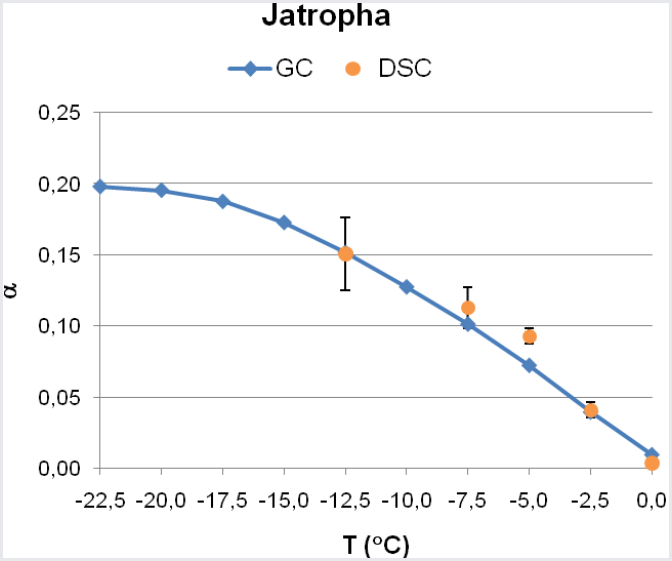

Palma
Fluxo de calor
-70 -60 -50 -40 -30 -20 -10 0 10 20 30
T (°C)

3. Fracção de fase sólida GC *vs.* DSC



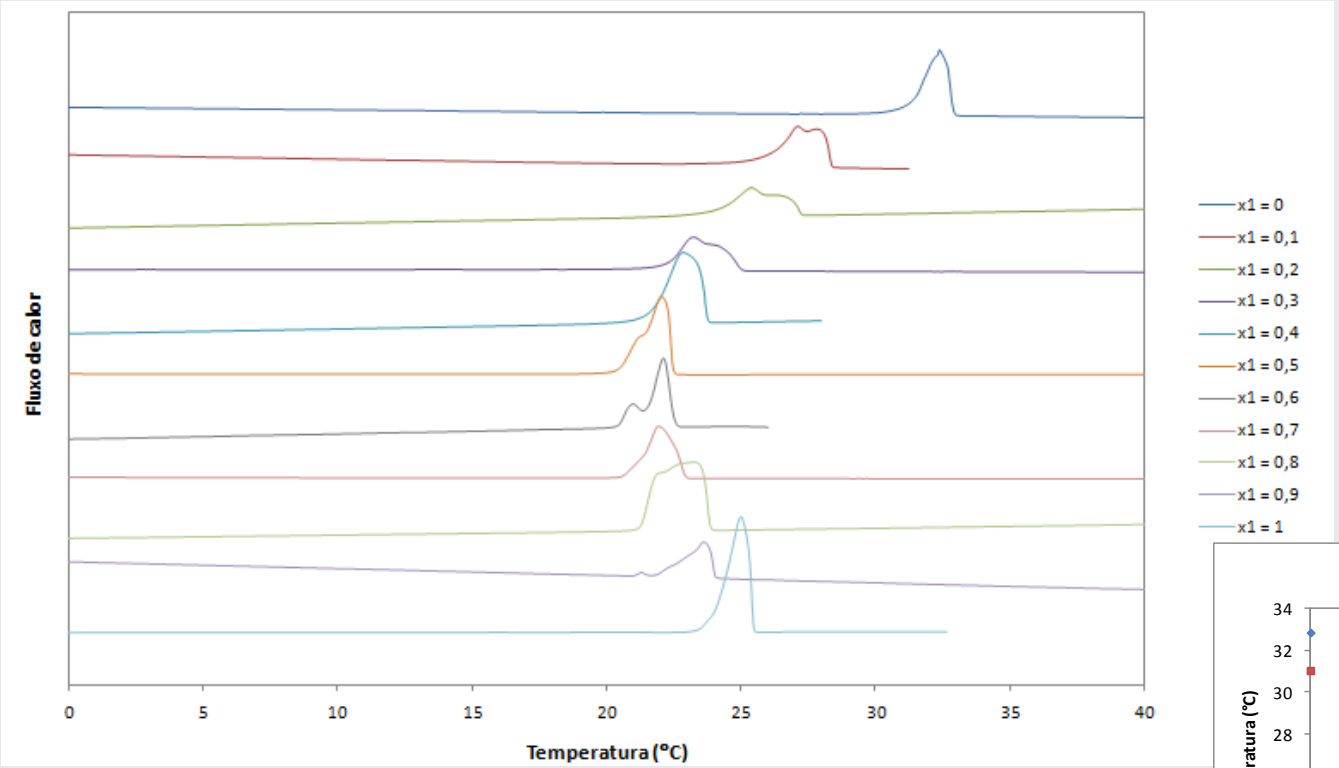


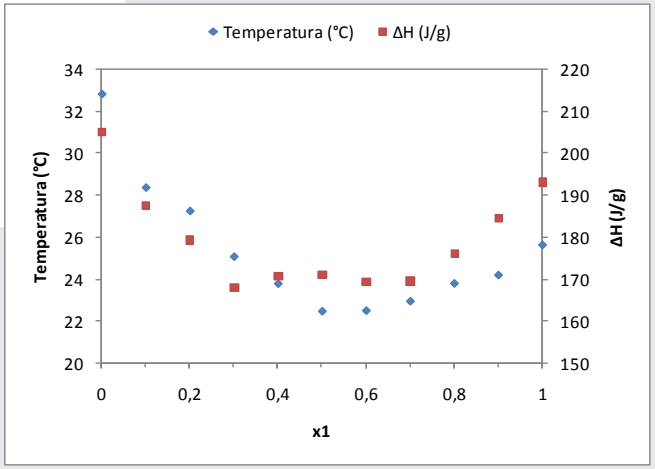




3. Sistemas binários

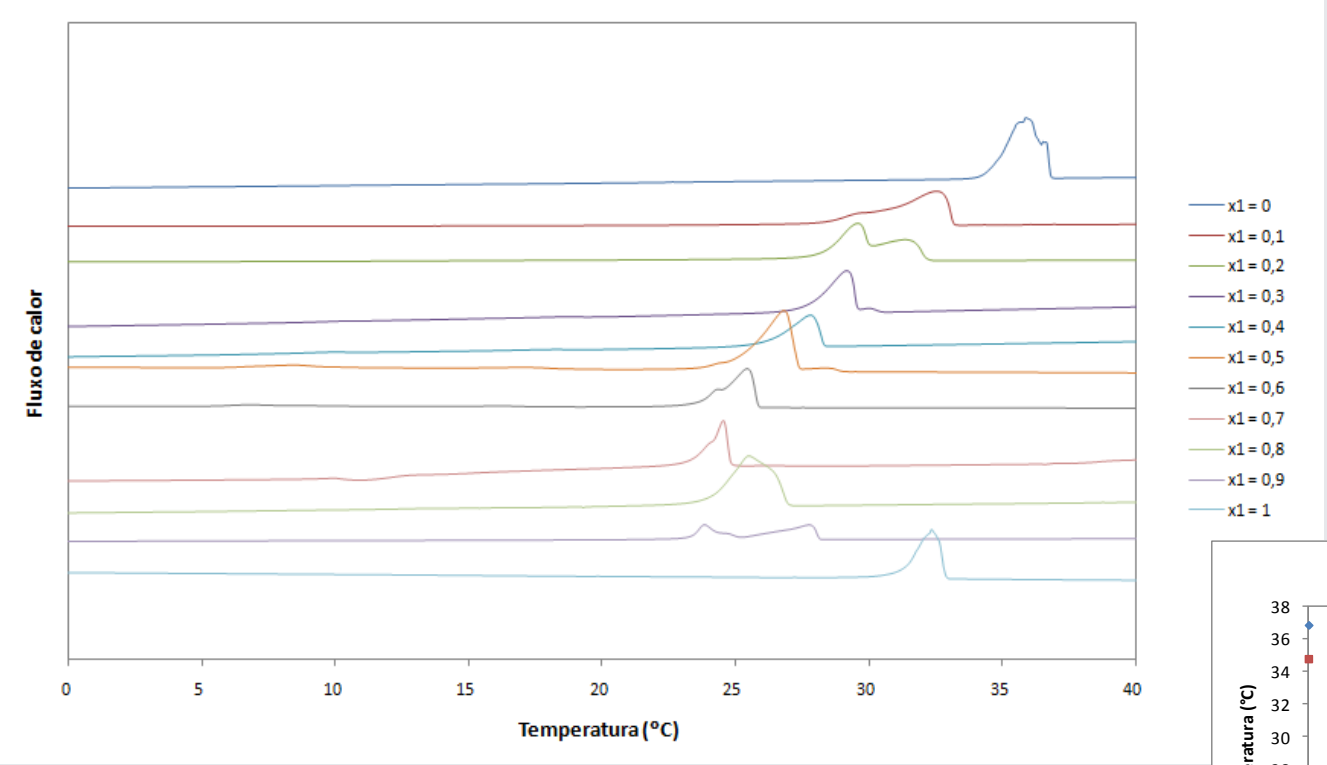
- Palmitato de etilo (1) + palmitato de metilo (2)

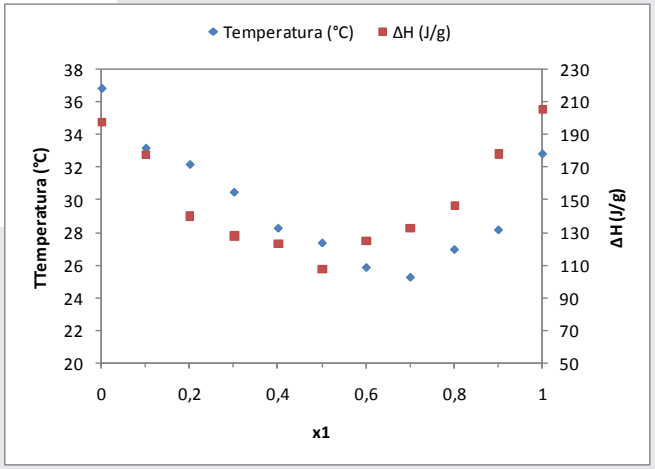




3. Sistemas binários

- Palmitato de metilo (1) + estearato de etilo (2)



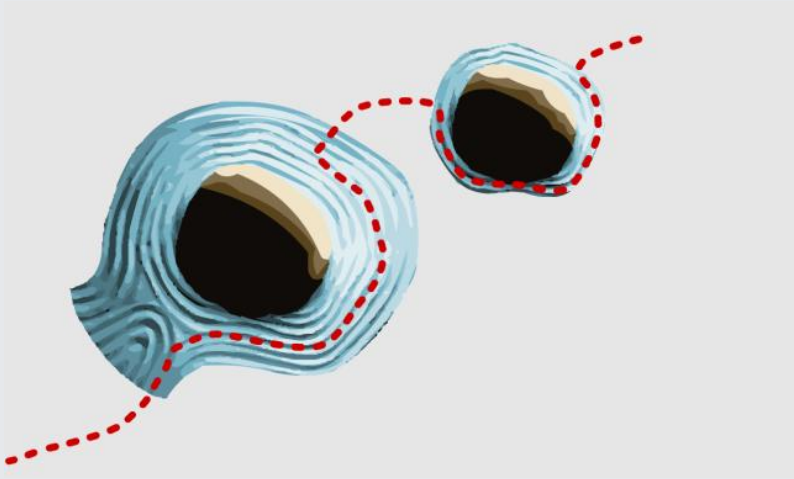


4. Conclusões

- Os PCMs são efectivamente um bom método para reduzir a utilização de sistemas de climatização.
- É possível separar FAMEs saturados do biodiesel.
- Ao retirar os FAMEs saturados do biodiesel reduz-se também o seu ponto de turvação.
- A utilização de misturas eutécticas de ésteres metílicos e etílicos permite aumentar a variedade de pontos de fusão.

4. Trabalho futuro

- Cubo com fibras de celulose + RT20.
- Estudo de diferentes diagramas de fase com misturas de binárias de esteres metílicos e etílicos.
- Estudo de diferentes biodieseis.

Agradecimentos

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