



**Title:** Capacidad de retención de antioxidantes de maltodextrina en jugo de arándano en polvo secado por aspersión

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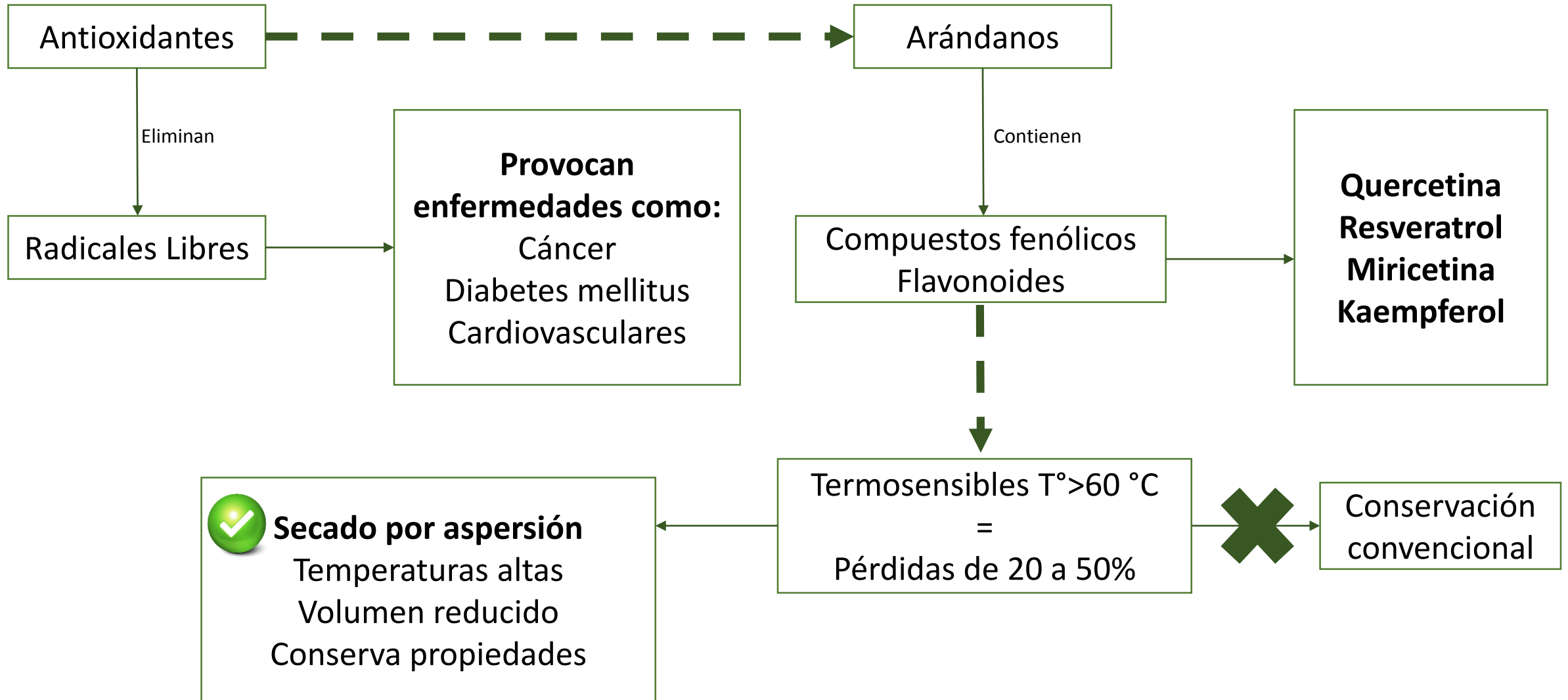
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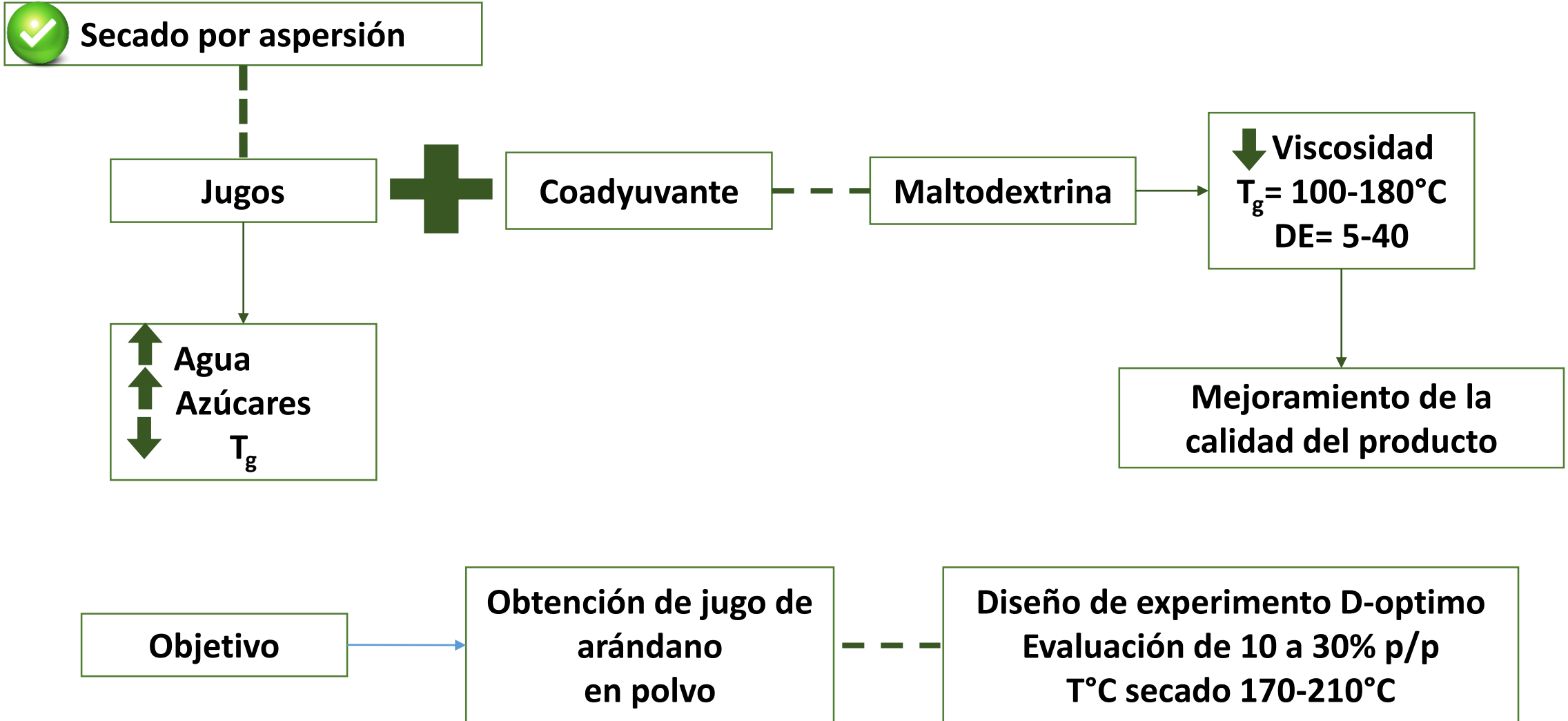
**Holdings**

|         |             |            |
|---------|-------------|------------|
| Mexico  | Colombia    | Guatemala  |
| Bolivia | Cameroon    | Democratic |
| Spain   | El Salvador | Republic   |
| Ecuador | Taiwan      | of Congo   |
| Peru    | Paraguay    | Nicaragua  |

# Introducción



# Introducción



# Metodología

Secado por  
aspersión

Diseño de  
experimentos

**Condiciones  
(Spray Dryer B290):**

T°C= Temperatura Ambiente  
Presión= 1.5 bar  
Flujo aire= 35 m<sup>3</sup>/h  
Capacidad= 30%  
T°C entrada= 170-210  
T°C entrada= 70-90  
Encapsulante= \*Maltodextrina

\* Diferentes equivalentes = M10, M20, M40

**D-óptimo-Minitab 17**

FACTORES A ANALIZAR

|                  |                                     |
|------------------|-------------------------------------|
| Temperatura (°C) | 170,175,181,187,<br>190,193,209,210 |
|------------------|-------------------------------------|

|   |                               |
|---|-------------------------------|
| Concentración<br>maltodextrina<br>(% p/P) | 10,12.5,18,20,22.<br>24,25,30 |
|---|-------------------------------|

|                          |                      |
|--------------------------|----------------------|
| Tipo de<br>Maltodextrina | Mc, M10, M20,<br>M40 |
|--------------------------|----------------------|

VARIABLES DE RESPUESTA

1. Rendimiento de polvo recolectado en p/p
2. Retención de antioxidantes del jugo de arándano µg/mL

25 corridas experimentales  
Análisis ANOVA

**Determinación del contenido de antioxidantes  
por CLAR**

**Condiciones**

(Cromatógrafo Waters):

T°C= Temperatura ambiente

Fase móvil= Acetonitrilo:  
Acido fórmico (70:30 v/v)

Flujo= 1 mL/min

λ= 306 nm

Columna= C18 (75x4.6 mm)

DI 3.5 µm

Volumen de inyección=  
10µL

CURVAS DE CALIBRACIÓN

Resveratol (1000 µg/mL)  
Quercetina (1000 µg/mL)  
en Metanol HPLC

DILUCIONES

0.01, 1.5, 10 y 20 µg/mL

**EXTRACCIÓN DE LAS  
MUESTRAS:**

Acetonitrilo/  
Ac. Fosfórico  
(0.01 %;  
50/50 v/v)

5gr  
triplicado

Agitación vigorosa  
5 minutos

Reposo oscuridad  
24 h

Filtrado  
Acroside 0.45µm

# Resultados

Rendimientos y condiciones de secado de las maltodextrina

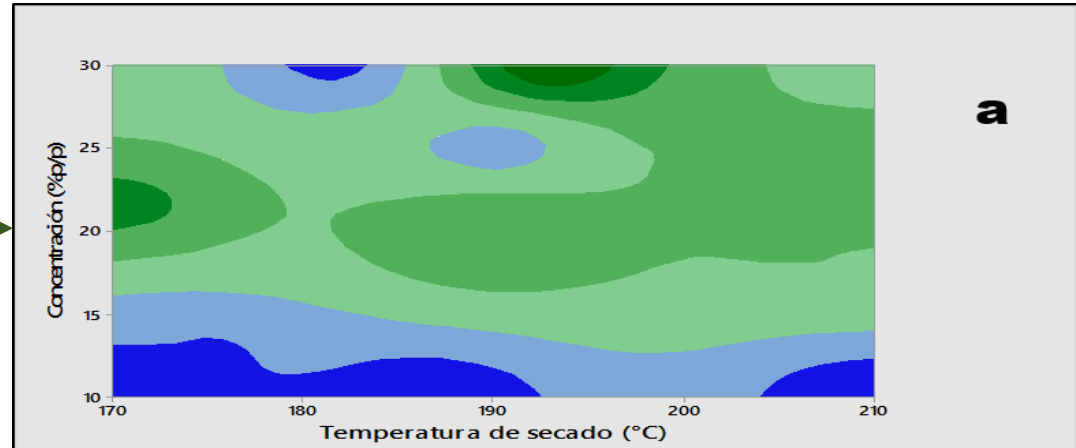
| *   | Concentración de MD* (% peso) | Concentración de jugo de arándano (% peso) | Temperatura de secado (°C) | Rendimiento (%) |
|-----|-------------------------------|--|----------------------------|-----------------|
| M40 | 30                            | 70   | 181                        | 2.02            |
| M10 | 30                            | 70   | 193                        | 9.68            |
| M10 | 30                            | 70   | 193                        | 11.87           |
| M20 | 25                            | 75   | 190                        | 2.81            |
| Mc  | 30                            | 70   | 210                        | 6.74            |
| M20 | 10                            | 90   | 170                        | 0               |
| Mc  | 30                            | 70   | 170                        | 6.37            |
| Mc  | 12.5                          | 87.5                                       | 175                        | 1.82            |
| M40 | 24                            | 76   | 209                        | 7.43            |
| M40 | 10                            | 90   | 210                        | 0               |
| M40 | 10                            | 90   | 170                        | 0               |
| M10 | 20                            | 80   | 190                        | 8.15            |
| M40 | 10                            | 90   | 170                        | 0               |
| M20 | 10                            | 90   | 170                        | 0               |
| Mc  | 20                            | 80   | 210                        | 7.68            |
| M20 | 30                            | 70   | 170                        | 4.23            |
| M40 | 30                            | 70   | 181                        | 1.25            |
| M10 | 10                            | 90   | 187                        | 0.12            |
| M10 | 22                            | 78   | 170                        | 9.48            |
| M20 | 10                            | 90   | 210                        | 0               |
| Mc  | 20                            | 80   | 190                        | 7               |
| M10 | 18                            | 82   | 210                        | 5.45            |
| Mc  | 10                            | 90   | 210                        | 0               |
| M10 | 22                            | 78   | 170                        | 8.37            |
| M20 | 20                            | 70   | 210                        | 2.02            |



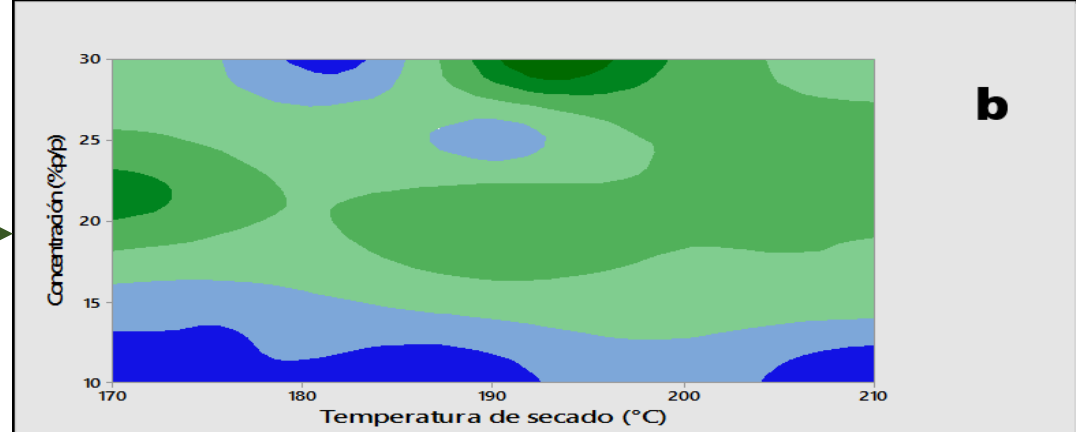
# Resultados

## Análisis D-Óptimo

Temperatura de secado-  
concentración de  
maltodextrina



Temperatura de  
secado-tipo de  
maltodextrina



Concentración de  
Maltodextrina-tipo de  
maltodextrina



# Resultados

## Análisis de varianza Rendimiento del Jugo de arándano en Polvo

|               | <b>GL</b> | <b>SC</b> | <b>MC</b> | <b>F</b> | <b>p</b> |
|---------------|-----------|-----------|-----------|----------|----------|
| Temperatura   | 8         | 119.7412  | 14.9676   | 5.854    | 0.248    |
| Concentración | 6         | 190.0694  | 31.6782   | 1.303    | 0.011    |
| Tipo de MD    | 5         | 9.1718    | 1.8344    | 2.578    | 0.000    |
| Error         | 3         | 0.6160    | 0.2053    |          |          |
| Total         | 22        | 319.5985  |           |          |          |

# Resultados

## Retención de antioxidantes



| MD     | Concentración de MD (%) | Concentración de jugo de arándano (%) | Temperatura de secado (°C) | Rendimiento (%) | Antioxidantes µg / mL |            |
|--------|-------------------------|---------------------------------------|----------------------------|-----------------|-----------------------|------------|
|        |                         |                                       |                            |                 | Resveratrol           | Quercetina |
| AJ-M40 | 30                      | 70                                    | 181                        | 2.02            |                       |            |
| AJ-M10 | 30                      | 70                                    | 193                        | 9.68            |                       |            |
| AJ-M10 | 30                      | 70                                    | 193                        | 11.87           | 0.140                 | 0.093      |
| AJ-M20 | 25                      | 75                                    | 190                        | 2.81            | ----                  | ----       |
| AJ-Mc  | 30                      | 70                                    | 210                        | 6.74            | ----                  | ----       |
| AJ-M20 | 10                      | 90                                    | 170                        | 0               | ----                  | ----       |
| AJ-Mc  | 30                      | 70                                    | 170                        | 6.37            | ----                  | ----       |
| AJ-Mc  | 12.5                    | 87.5                                  | 175                        | 1.82            | ----                  | ----       |
| AJ-M40 | 24                      | 76                                    | 209                        | 7.43            | ----                  | ----       |
| AJ-M40 | 10                      | 90                                    | 210                        | 0               | ----                  | ----       |
| AJ-M40 | 10                      | 90                                    | 170                        | 0               | ----                  | ----       |
| AJ-M10 | 20                      | 80                                    | 190                        | 8.15            | ----                  | ----       |
| AJ-M40 | 10                      | 90                                    | 170                        | 0               | ----                  | ----       |
| AJ-M20 | 10                      | 90                                    | 170                        | 0               | ----                  | ----       |
| AJ-Mc  | 20                      | 80                                    | 210                        | 7.68            | ----                  | ----       |
| AJ-M20 | 30                      | 70                                    | 170                        | 4.23            | ----                  | ----       |
| AJ-M40 | 30                      | 70                                    | 181                        | 1.25            | ----                  | ----       |
| AJ-M10 | 10                      | 90                                    | 187                        | 0.12            | ----                  | ----       |
| AJ-M10 | 22                      | 78                                    | 170                        | 9.48            | ----                  | ----       |
| AJ-M20 | 10                      | 90                                    | 210                        | 0               | ----                  | ----       |
| AJ-Mc  | 20                      | 80                                    | 190                        | 7               | ----                  | ----       |
| AJ-M10 | 18                      | 82                                    | 210                        | 5.45            | ----                  | ----       |
| AJ-Mc  | 10                      | 90                                    | 210                        | 0               | ----                  | ----       |
| AJ-M10 | 22                      | 78                                    | 170                        | 8.37            | ----                  | ----       |
| AJ-M20 | 30                      | 70                                    | 210                        | 3.03            | ----                  | ----       |
|        |                         |                                       |                            |                 | 0.662                 | 0.326      |



# Conclusiones

Con base en los resultados obtenidos de las curvas de contorno se puede establecer que la maltodextrina M10 es el agente acarreador que permite obtener los mejores rendimientos, así mismo fue la única MD que presentó retención de antioxidantes resveratrol y quercetina en un porcentaje aproximado de 20% y 30%, respectivamente.

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