**Cinética de degradación térmica de poliácido láctico en múltiples extrusiones** [[1]](#footnote-1)

**Tabla 1. Métodos cinéticos empleados para determinar el triplete cinético**

|  |  |  |  |
| --- | --- | --- | --- |
| **Método** | **Ecuación** | **Fuente** | |
| Flynn-Wall-Ozawa - FWO |  | Park et al., 2000 | |
| Friedman |  | Kim y Oh, 2005 | |
| Gyulai-Greenhow |  | Mallakpour y Taghavi, 2009 | |
| Kissinger-Akahira-Sunose - KAS |  | Aboulkas et al., 2010 | |
| Kissinger |  | Kim y Oh, 2005 | |
| Arrhenius Diferencial |  | Wan et al., 2005 |
| Arrhenius  Integral |  | Wan et al., 2005 | |
| Briodo |  | Kim y Oh, 2005 | |
| Chang |  | Wan et al., 2005 | |
| Coats-Redfern | n = 1  n ≠ 1 | Mallakpour y Taghavi, 2009 | |
| Flynn-Wall |  | Wan et al., 2005 | |
| Horowitz-  Metzger | n = 1  n ≠ 1 | Kim y Oh, 2005 | |
| MacCallum-  Tanner |  | Mallakpour y Taghavi, 2009 | |
| Madhusudanan |  | Wan et al., 2005 | |
| Método Dinámico |  | Kim y Oh, 2005 | |

**Fuente: Presentación propia de los autores**

**Tabla 2. Características físicas del PLA sin procesar y extruido**

|  |  |  |  |
| --- | --- | --- | --- |
| **Polímero** | **Temperatura de transición vítrea, *Tg*, °C** | **Índice de fluidez**  **g/10 min** | **Poder Calorífico Superior, kJ/kg** |
| Sin procesar | 63 | 14.20 | 18562 |
| Ext. 1 | 62 | 17.10 | 18560 |
| Ext. 2 | 63 | 18.50 | 18555 |
| Ext. 3 | 63 | 21.50 | 18534 |
| Ext. 4 | 64 | 22.90 | 18527 |
| Ext. 5 | 64 | 24.70 | 18502 |

**Fuente: Presentación propia de los autores**

**Tabla 3. Resultados triplete cinético para métodos no isoconversionales**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Extrusión,**  **B**  **(°C/min)** | **Briodo** | | **Diferencial Arrhenius** | | **Integral de Arrhenius** | | **Horowitz - Metzger** |
| **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** |
| Ext. 0, 5 | 212.67 | 40.90 | 244.57 | 46.12 | 212.67 | 40.73 | 74.84 |
| 10 | 284.31 | 54.49 | 265.50 | 49.68 | 284.31 | 54.31 | 100.86 |
| 20 | 217.73 | 41.36 | 241.21 | 44.75 | 217.73 | 41.18 | 83.39 |
| 40 | 264.53 | 49.48 | 298.81 | 54.77 | 264.53 | 49.34 | 102.66 |
| Ext. 1, 5 | 203.01 | 39.00 | 158.07 | 28.38 | 203.01 | 38.84 | 72.93 |
| 10 | 244.25 | 46.64 | 273.05 | 50.85 | 244.25 | 46.40 | 88.99 |
| 20 | 247.67 | 47.14 | 260.56 | 48.39 | 247.67 | 46.96 | 92.19 |
| 40 | 296.82 | 55.65 | 283.47 | 52.10 | 296.82 | 55.52 | 110.77 |
| Ext. 2, 5 | 252.80 | 49.45 | 277.13 | 52.96 | 252.80 | 49.30 | 85.01 |
| 10 | 239.62 | 46.19 | 267.99 | 50.61 | 239.62 | 46.05 | 86.47 |
| 20 | 257.36 | 49.04 | 266.28 | 49.63 | 257.36 | 48.89 | 94.94 |
| 40 | 292.53 | 55.56 | 271.04 | 50.50 | 292.53 | 55.47 | 107.34 |
| Ext. 3, 5 | 222.52 | 43.51 | 255.56 | 49.01 | 222.52 | 43.33 | 74.59 |
| 10 | 250.64 | 48.69 | 278.43 | 52.82 | 250.64 | 48.52 | 88.07 |
| 20 | 280.49 | 54.07 | 270.11 | 50.99 | 280.49 | 53.93 | 99.46 |
| 40 | 281.42 | 53.28 | 298.87 | 55.43 | 281.42 | 53.15 | 104.77 |
| Ext. 4, 5 | 246.08 | 48.48 | 268.71 | 51.74 | 246.08 | 48.33 | 80.53 |
| 10 | 278.78 | 54.02 | 291.54 | 55.36 | 278.78 | 53.89 | 96.60 |
| 20 | 289.43 | 55.64 | 311.34 | 58.64 | 289.43 | 55.50 | 103.57 |
| 40 | 297.68 | 56.60 | 329.75 | 61.39 | 297.68 | 56.47 | 109.22 |
| Ext. 5, 5 | 233.81 | 46.04 | 261.18 | 50.29 | 233.81 | 45.88 | 78.27 |
| 10 | 259.65 | 50.82 | 259.25 | 49.51 | 259.65 | 50.63 | 89.62 |
| 20 | 260.14 | 50.10 | 318.48 | 60.06 | 260.14 | 49.96 | 93.49 |
| 40 | 294.26 | 55.99 | 276.63 | 51.55 | 294.26 | 55.82 | 107.93 |

**Fuente: Presentación propia de los autores**

**Tabla 4. Resultados triplete cinético para algunos métodos isoconversionales**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Muestra** | **Kissinger** | | **KAS** | | **FWO** | | **Gyulai** | | **Friedman** | | |
| **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **E**  **(kJ/mol)** | **Ln A**  **(min-1)** | **n** |
| Ext. 0 | 149.69 | 27.50 | 148.26 | 26.60 | 151.06 | 27.48 | 149.58 | 27.06 | 140.58 | 25.17 | 0.23 |
| Ext. 1 | 144.73 | 26.51 | 150.13 | 27.23 | 152.88 | 27.77 | 151.45 | 27.47 | 156.82 | 28.43 | 0.39 |
| Ext. 2 | 165.46 | 30.86 | 153.75 | 28.24 | 156.39 | 28.80 | 155.06 | 28.46 | 145.49 | 26.49 | 0.27 |
| Ext. 3 | 137.82 | 25.50 | 141.84 | 25.97 | 145.00 | 26.69 | 143.29 | 26.20 | 144.33 | 26.41 | 0.35 |
| Ext. 4 | 146.92 | 27.35 | 142.92 | 26.15 | 145.83 | 26.85 | 144.16 | 26.37 | 151.12 | 27.71 | 0.25 |
| Ext. 5 | 145.24 | 27.14 | 138.21 | 25.34 | 141.32 | 26.10 | 139.51 | 25.56 | 135.52 | 24.82 | 0.29 |

**Fuente: Presentación propia de los autores**

**Tabla 5. Valores del promedio de los residuos para los métodos isoconversionales ()**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Proc.** | **Kissinger** | **KAS** | **FWO** | **Gyulai** | **Friedman** |
| 0 | 2.741 | 2.250 | 0.350 | 0.299 | -0.976 |
| 1 | 3.315 | 2.221 | 0.728 | 0.751 | -1.081 |
| 2 | 2.981 | 2.083 | 0.013 | -0.024 | -0.977 |
| 3 | 3.602 | 2.077 | -3.016 | 0.360 | -1.373 |
| 4 | 3.884 | 2.042 | -3.021 | -0.405 | -1.730 |
| 5 | 3.474 | 1.989 | -2.994 | 0.034 | -1.125 |

**Fuente: Presentación propia de los autores**

1. [↑](#footnote-ref-1)