

Bibliografia

- Alves, S. S.; Figueiredo, J. L. (1988) Pyrolysis Kinetics of Lignocellulosic Materials by Multisatge Isothermal Thermogravimetry. *Journal of Analytical and Applied Pyrolysis*, 13, 123–134.
- Alves, S. S.; Figueiredo, J. L. (1989a) Interpreting Isothermal Thermogravimetric Data of Complex Reactions: Applications to Cellulose Pyrolysis at Low Temperatures. *Journal of Analytical and Applied Pyrolysis*, 15: 347–355.
- Alves, S. S.; Figueiredo, J. L. (1989b) Kinetics of Cellulose Pyrolysis Modelled by Three Consecutive First-Order Reactions. *Journal of Analytical and Applied Pyrolysis*, 17: 37–46.
- Antal, M. J. (1982) Thermogravimetric Signatures of Complex Solid Phase Pyrolysis Mechanisms and Kinetics. A: Miller, B. (ed.) *Thermal Analysis Proceedings of the Seventh ICTA*. Nova York: J. Wiley.
- Antal, M. J.; Friedman, H.; Roger, F. (1980) Kinetics of Cellulose Pyrolysis in Nitrogen and Steam. *Combustion Science and Technology*, 21: 141–152.
- Antal, M. J.; Mok, W. S.-L.; Roy, J. C.; T-Raissi, A.; Anderson, D. G. M. A. (1985) Pyrolytic Sources of Hydrocarbons from Biomass. *Journal of Analytical and Applied Pyrolysis*, 8: 291–303.
- Antal M. J.; Mok, W. S.-L.; Várhegyi, G.; Szekely, T. (1990) Review of Methods for Improving the Yield of Charcoal from Biomass. *Energy and Fuels*, 4: 221–225.
- Antal, M. J.; Várhegyi, G. (1995) Cellulose Pyrolysis Kinetics: The Current State of Knowledge. *Industrial and Engineering Chemistry Research*, 34: 703–717.
- Antal, M. J.; Croiset, E.; Dai, X. F.; DeAlmeida, C.; Mok, W. S.-L.; Norberg, N.; Richard, J. R.; Mathoub, M. A. (1996) A High-Yield Biomass Charcoal. *Energy and Fuels*, 10: 652.
- Antal, M. J.; Várhegyi, G.; Jakab, E. (1998) Cellulose Pyrolysis Kinetics: Revisited. *Industrial and Engineering Chemistry Research*, 37: 1267–1275.
- Antal, M. J.; Allen, S. G.; Dai, X.; Shimizu, B.; Tam, M. S.; Gronli, M. (2000) Attainment of the Theoretical Yield of Carbon from Biomass. *Industrial and Engineering Chemistry Research*, 39: 4024–4031.
- Anthony, D. B.; Howard, J. B. (1976) Coal devolatilization and hydrogasification. *AIChE Journal*, 22: 525.
- ASTM (2001) D1762-84. *Standard Test Method for Chemical Analysis of Wood Charcoal*.
- Beenackers A. A. C. M.; Maniatis, K. (1997) Gasification Technologies for Heat and Power from Biomass. A: Kaltschmitt, M.; Bridgwater, A. V. (ed.) *Biomass Gasification and Pyrolysis —state of the art and future prospects*. Newbury: CPL Press per a la Comissió Europea, p. 24–52.
- Biagini, E.; Lippi, F.; Petarca, L.; Tognotti, L. (2002) Devolatilization rate of biomasses and coal-biomass blends: an experimental investigation. *Fuel*, 81: 1041–1050.
- Bilbao, R.; Arauzo, J.; Millera, A. (1987a) Kinetics of Thermal Decomposition of Cellulose. Part I. *Thermochimica Acta*, 120: 121–131.

- Bilbao, R.; Arauzo, J.; Millera, A. (1987b) Kinetics of Thermal Decomposition of Cellulose. Part II. *Thermochimica Acta*, 120: 133–141.
- Bilbao, R.; Millera, A.; Arauzo, J. (1989) Thermal Decomposition of Lignocellulosic Materials: Influence of the Chemical Composition. *Thermochimica Acta*, 143: 149–159.
- Bilbao, R.; Murillo, M. B.; Millera, A.; Arauzo, J.; Caleya, J. M. (1992) Thermal Decomposition of a Wood Particle. *Thermochimica Acta*, 197: 431–442.
- Bingyan, X.; Chuangzhi, W.; Zhengfen, L.; Xiguang, Z. (1992) Kinetic Study of Biomass Gasification. *Solar Energy*, 49 (3): 199–204.
- Bradbury, A. G. W.; Sakai, Y.; Shafizadeh, F. (1979) A Kinetic Model for Pyrolysis of Cellulose. *Journal of Applied Polymer Science*, 23: 3271–3280.
- Bridgwater, A. V. (1997) Fast Pyrolysis of Biomass in Europe. In: Kaltschmitt, M.; Bridgwater, A. V. (ed.) *Biomass Gasification and Pyrolysis —state of the art and future prospects*. Newbury: CPL Press per a la Comissió Europea, p. 53–67.
- Broido, A. (1976) Kinetics of Solid-Phase Cellulose Pyrolysis. In: Shafizadeh, F.; Sarkanen, K. V.; Tillman, D. A. (ed.) *Thermal Uses and Properties of Carbohydrates and Lignins*. Nova York: Academic Press, p. 19–35.
- Broido, A.; Weinstein, M. (1971) Kinetics of solid-phase cellulose pyrolysis. In: Wiedemann (ed.) *Proceedings of the 3rd International Conference on Thermal Analysis*. Basilea: Birkhauser Verlag, p. 285–296.
- Broido, A.; Nelson, M. A. (1975) Char Yield on Pyrolysis of Cellulose. *Combustion and Flame*, 24: 263–268.
- Castro Gil, M.; Sánchez Naranjo, C. (1997) *Biocombustibles*. Sevilla: Progensa.
- Chornet, E.; Roy, C. (1980) Compensation Effect in the Thermal Decomposition of Cellulosic Materials. *Thermochimica Acta*, 35: 389–393.
- Conesa, J. A.; Marcilla, A.; Caballero, J. A.; Font, R. (2001) Comments on the validity and utility of the different methods for kinetic analysis of thermogravimetric data. *Journal of Analytical and Applied Pyrolysis*, 58-59: 617–633.
- Cooley, S.; Antal, M. J. (1988) Kinetics of Cellulose Pyrolysis in the Presence of Nitric Oxide. *Journal of Analytical and Applied Pyrolysis*, 14: 149–161.
- Cozzani, V.; Lucchesi, A.; Stoppato, G.; Maschio, G. (1997) A new method to determine the composition of biomass by thermogravimetric analysis. *The Canadian Journal of Chemical Engineering*, 75: 127.
- Cutlip, M. B.; Shacham, M. (1999) *Problem Solving in Chemical Engineering with Numerical Methods*. Prentice Hall. Inclou un CD-ROM amb el programa Polymath v. 4.1. ISBN 0-13-862566-2.
- Di Blasi, C. (1993) Analysis of convection and secondary reaction effects within porous solid fuels undergoing pyrolysis. *Combustion Science and Technology*, 90: 315–340.

- Di Blasi, C. (1994) Numerical Simulation of Cellulose Pyrolysis. *Biomass and Bioenergy*, 7: 87–98.
- Di Blasi, C. (1996) Kinetic and Heat Transfer Control in the Slow and Flash Pyrolysis of Solids. *Industrial and Engineering Chemistry Research*, 35: 37–46.
- Di Blasi, C.; Russo, G. (1994) Modeling of transport phenomena and kinetics of biomass pyrolysis. A: Bridgwater, A. V. (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2, p. 906–921.
- Di Blasi, C.; Signorelli, G.; Di Russo, C.; Rea, G. (1999) Product Distribution from Pyrolysis of Wood and Agricultural Residues. *Industrial and Engineering Chemistry Research*, 38: 2216–2224.
- Di Blasi, C.; Branca, C. (2001) Kinetics of Primary Product Formation from Wood Pyrolysis. *Industrial and Engineering Chemistry Research*, 40: 5547–5556.
- Di Blasi, C.; Branca, C.; Santoro, A.; Bermudez, R. A. P. (2001) Weight loss dynamics of wood chips under fast radiative heating. *Journal of Analytical and Applied Pyrolysis*, 57: 77–90.
- Drummond, A.-R. F.; Drummond, I. W. (1996) Pyrolysis of Sugar Cane Bagasse in a Wire-Mesh Reactor. *Industrial and Engineering Chemistry Research*, 35: 1263–1268.
- EREN (U.S. Department of Energy. Energy Efficiency and Renewable Energy Network) (2000) *Glossary of terms for the biomass feedstock composition and properties database*. [en línia] Pàgina web, URL <<http://www.ott.doe.gov/biofuels/glossary.html>>. [consulta el 8 de març de 2001]
- Essig, M. G.; Richards, G. N.; Schenck, E. M. (1989) Mechanisms of Formation of the Major Volatile Products from the Pyrolysis of Cellulose. A: Schuerch, C. (ed.) *Cellulose and Wood Chemistry and Technology*. Nova York: J. Wiley & Sons.
- Eurostat (1995) *Renewable Energy Sources Statistics*. Luxemburg: The Statistical Office of the European Communities.
- Evans, R. J.; Milne, T. A. (1987) Molecular Characterization of the Pyrolysis of Biomass. 1. Fundamentals. *Energy and Fuels*, 1: 123–137.
- Faix, O.; Jakab, E.; Till, F.; Szekely, T. (1988) Study on Low Mass Thermal Degradation Products of Milled Woods Lignins by Thermogravimetry–Mass Spectrometry. *Wood Science and Technology*, 22: 323–334.
- Fengel, D.; Gerd, W. (1989) *Wood Chemistry, Ultrastructure, and Reactions*. Berlín-Nova York: Walter de Gruyter.
- Font, R.; Marcilla, A.; Verdu, E.; Devesa, J. (1991) Thermogravimetric Kinetic Study of the Pyrolysis of Almond Shells and Almond Shells Impregnated with CoCl₂. *Journal of Analytical and Applied Pyrolysis*, 21: 249–264.
- Forsythe, B. E.; Malcolm, M. A.; Moler, C. B. (1977) *Computer Methods for Mathematical Computation*. Englewood Cliffs, NJ: Prentice Hall.
- Friedman, H. L. (1965) *Journal of Polymer Science*, part C, 6: 183.

- Gronli, M.; Antal, M. J.; Várhegyi, G. (1999) A Round-Robin Study of Cellulose Pyrolysis Kinetics by Thermogravimetry. *Industrial and Engineering Chemistry Research*, 38: 2238–2244.
- Güell, A. J.; Li, C. Z.; Herod, A. A.; Stokes, B. J.; Hancock, P.; Kandiyoti, R. (1994) Mild Hydropyrolysis of Biomass Materials: Effect of Pressure on Product Tar Structures. A: Bridgwater, A. V. (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2, p. 1053–1067.
- Hajaligol, M. R.; Howard, J. B.; Longwell, J. P.; Peters, W. A. (1982) Product Compositions and Kinetics for Rapid Pyrolysis of Cellulose. *Industrial and Engineering Chemistry, Process Design and Development*, 21: 457–465.
- Hallgren, A.; Wanzl, W. (1994) Screening of pyrolysis behavior of different biomass. A: Bridgwater, A. V. (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2, p. 806–817.
- Härdlein, M.; Kaltschmitt, M. (1996) Wirtschaftlichkeitsanalyse einer Wärmebereitstellung aus Biomasse in Großanlagen. Einfluß staatlicher Maßnahmen auf die Wirtschaftlichkeit. *Energie and Management*, 21.
- Kaltschmitt, M.; Dinkelbach, L. (1997) Biomass for energy in Europe —status and prospects. A: Kaltschmitt, M.; Bridgwater, A. V. (ed.) *Biomass Gasification and Pyrolysis —state of the art and future prospects*. Newbury: CPL Press per a la Comissió Europea, p. 7–23.
- Koufopanos, C. A.; Maschio, G.; Lucchesi, A. (1989) Kinetic Modeling of the Pyrolysis of Biomass and Biomass Components. *The Canadian Journal of Chemical Engineering*, 67: 75–84.
- Koufopanos, C. A.; Papayannakos, N.; Maschio, G.; Lucchesi, A. (1991) Modeling of the pyrolysis of biomass particles. Studies on kinetics, thermal and heat transfer effects. *The Canadian Journal of Chemical Engineering*, 69: 907–915.
- Liden, A. G.; Berruti, F.; Scott, D. S. (1988) A kinetic model for the production of liquids from the flash pyrolysis of biomass. *Chemical Engineering Communication*, 65: 207–221.
- Liou, T. H.; Chang, F. W.; Lo, J. J. (1997) Pyrolysis of Acid-Leached Rice Husk. *Industrial and Engineering Chemistry Research*, 36: 568.
- Maschio, G.; Lucchesi, A.; Koufopanos, C. A. (1994) Study of kinetic and transfer phenomena in the pyrolysis of biomass particles. A: Bridgwater, A. V. (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2, p. 746–759.
- Miller, R. S.; Bellan, J. (1996) Analysis of reaction products and conversion time in the pyrolysis of cellulose and wood particles. *Combustion Science and Technology*, 119: 331–373.
- Miller, R. S.; Bellan, J. (1997) A Generalized Biomass Pyrolysis Model Based on Superimposed Cellulose, Hemicellulose and Lignin Kinetics. *Combustion Science and Technology*, 126: 97–137.
- Milosavljevic, I.; Suuberg, E. M. (1995) Cellulose Thermal Decomposition Kinetics: Global Mass Loss Kinetics. *Industrial and Engineering Chemistry Research*, 34: 1081–1091.

- Mok, W. S.-L.; Antal, M. J. (1983a) Effects of Pressure on Biomass Pyrolysis. I. Cellulose Pyrolysis Products. *Thermochimica Acta*, 68: 155–164.
- Mok, W. S.-L.; Antal, M. J. (1983b) Effects of Pressure on Biomass Pyrolysis. II. Heats of Reaction of Cellulose Pyrolysis. *Thermochimica Acta*, 68: 165–186.
- Mok, W. S.-L.; Antal, M. J.; Szabo, P.; Várhegyi, G.; Zelei, B. (1992) Formation of Charcoal from Biomass in a Sealed Reactor. *Industrial and Engineering Chemistry Research*, 31: 1162–1166.
- Morris, K. (1999) *BiothermTM: A System for Continuous Quality, Fast Pyrolysis BioOil*. Comunicació presentada a la 4th Biomass Conference of the Americas, Oakland, CA. [en línia] Pàgina web, URL <<http://www.dynamotive.com>>. [consulta el 13 de març de 2001]
- Narayan, R.; Antal, M. J. (1996) Thermal Lag, Fusion, and the Compensation Effect during Biomass Pyrolysis. *Industrial and Engineering Chemistry Research*, 35: 1711–1721.
- NREL (2002) *Laboratory Analytical Methods: Standard Biomass Analytical Methods*. [en línia] Pàgina web, URL <http://www.ott.doe.gov/biofuels/analytical_methods.html#LAP-001>. Disponible en format PDF [consulta el 3 de gener de 2002]
- Nunn, T. R.; Howard, J. B.; Longwell, J. P.; Peters, W. A. (1985) Product Compositions and Kinetics in the Rapid Pyrolysis of Sweet Gum Hardwood. *Industrial and Engineering Chemistry, Process Design and Development*, 24: 836–844.
- Orfao, J. J. M.; Antunes, F. J. A.; Figueiredo, J. L. (1999) Pyrolysis Kinetics of Lignocellulosic Materials—Three Independent Reactions Model. *Fuel*, 78: 349–358.
- Ouensanga, A.; Picard, C. (1988) Thermal Degradation of Sugar Cane Bagasse. *Thermochimica Acta*, 125: 89–97.
- Piskorz, J.; Radlein, D.; Scott, D. S. (1986) On the Mechanism of the Rapid Pyrolysis of Cellulose. *Journal of Analytical and Applied Pyrolysis*, 9: 121–137.
- Pouwels, A. D.; Eijkel, G. B.; Boon, J. J. (1989) Curie-Point Pyrolysis Capillary Gas Chromatography–High Resolution Mass Spectrometry of Microcrystalline Cellulose. *Journal of Analytical and Applied Pyrolysis*, 14: 237–280.
- Press, W. H.; Flannery, P. B.; Teukolsky, S. A.; Vetterling, W. T. (1992) *Numerical Recipes*. 2a ed. Cambridge University Press.
- Radlein, D.; Piskorz, J.; Scott, D. S. (1991) Fast Pyrolysis of Natural Polysaccharides as a Potential Industrial Process. *Journal of Analytical and Applied Pyrolysis*, 19: 41–63.
- Reina, J. (1999) Estudio cinético e hidrodinámico de la pirólisis de maderas residuales para su gasificación en reactor de lecho fluidizado. Tesi doctoral. Universitat Politècnica de Catalunya, Departament d'Enginyeria Química.
- Reina, J.; Velo, E.; Puigjaner, L. (1998) Kinetic Study of the Pyrolysis of Waste Wood. *Industrial and Engineering Chemistry Research*, 37: 4290–4295.

- Richard, J.-R.; Antal, M. J. (1994) Thermogravimetric Studies of Charcoal Formation from Cellulose at Elevated Pressures. A: Bridgwater, A. V. (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2.
- Richards, G. N. (1991) Influence of Metal Ions and of Salts from Pyrolysis of Wood: Applications to Thermochemical Processing of Newsprint and Biomass. *Journal of Analytical and Applied Pyrolysis*, 21: 133–146.
- Scott, D. S.; Piskorz, J. (1982) The flash pyrolysis of aspen-poplar wood. *The Canadian Journal of Chemical Engineering*, 60: 666–674.
- Scott, D. S.; Piskorz, J.; Bergougnou, M. A.; Graham, R.; Overend, R. P. (1988) The Role of Temperature in the Fast Pyrolysis of Cellulose and Wood. *Industrial and Engineering Chemistry Research*, 27: 8–15.
- Scott, D. S.; Paterson, L.; Piskorz, J.; Radlein, D. (2000) Pretreatment of poplar wood for fast pyrolysis rate of cation removal. *Journal of Analytical and Applied Pyrolysis*, 57: 169–176.
- Sesták, J. (1984) *Thermophysical Properties of Solids. Their Measurements and Theoretical Thermal Analysis*. Praga: Ed. Academia Praha.
- Shafizadeh, F.; McGinnis, G. D. (1971) *Carbohydrates Research*, 16: 273.
- Shafizadeh, F.; Chin, P. P. S. (1977) Thermal deterioration of wood. *ACS Symp. Ser.*, 43: 57.
- Shafizadeh, F.; Furneaux, R. H.; Cochran, T. G.; Scholl, J. P.; Sakai, Y. (1979) Production of levoglucosan and glucose from pyrolysis of cellulosic materials. *Journal of Applied Polymer Science*, 23: 3525–3539.
- Simmons, G. M.; Gentry, M. (1986) Particle size limitations due to heat transfer in determining pyrolysis kinetics of biomass. *Journal of Analytical and Applied Pyrolysis*, 10: 117–127.
- Sorum, L.; Gronli, M. G.; Hustad, J. E. (2001) Pyrolysis characteristics and kinetics of municipal solid wastes. *Fuel*, 80: 1217–1227.
- Stenseng, M.; Jensen, A.; Dam-Johansen, K. (2001) Investigation of biomass pyrolysis by thermogravimetric analysis and differential scanning calorimetry. *Journal of Analytical and Applied Pyrolysis*, 58-59: 765–780.
- Stubington, J. F.; Aiman, S. (1994) Pyrolysis Kinetics of Bagasse at High Heating Rates. *Energy and Fuels*, 8: 194–203.
- TAB (Office of Technology Assessment at the German Parliament) (2001) *Summary of TAB working report (number 49): Gasification and Pyrolysis of Biomass*. [en línia] Pàgina web, URL <<http://www.tab.fzk.de/en/projekt/zusammenfassung/AB49.html>>. [consulta el 4 de desembre de 2001]
- Teng, H.; Wei, Y.-C. (1998) Thermogravimetric Studies on the Kinetics of Rice Hull Pyrolysis and the Influence of Water Treatment. *Industrial and Engineering Chemistry Research*, 37: 3806–3811.
- The Lignin Institute (2001) Lignin and its properties. Glossary of Lignin Nomenclature. *Dialogue*, vol. 9 (1). [en línia] Pàgina web, URL <<http://www.lignin.info/01augdialogue.html>>. [consulta l'11 de febrer de 2002]

- Thurner, F.; Mann, U. (1981) Kinetic Investigation of Wood Pyrolysis. *Industrial and Engineering Chemistry, Process Design and Development*, 20: 482–488.
- Várhegyi, G.; Antal, M. J.; Szekely, T.; Till, F.; Jakab, E. (1988a) Simultaneous Thermogravimetric-Mass Spectrometric Studies of the Thermal Decomposition of Biopolymers. 1. Avicel Cellulose in the Presence and Absence of Catalysts. *Energy and Fuels*, 2: 267–272.
- Várhegyi, G.; Antal, M. J.; Szekely, T.; Till, F.; Jakab, E. (1988b) Simultaneous Thermogravimetric-Mass Spectrometric Studies of the Thermal Decomposition of Biopolymers. 2. Sugar Cane Bagasse in the Presence and Absence of Catalysts. *Energy and Fuels*, 2: 273–277.
- Várhegyi, G.; Antal, M. J.; Szekely, T.; Szabo, P. (1989) Kinetics of the Thermal Decomposition of Cellulose, Hemicellulose, and Sugar Cane Bagasse. *Energy and Fuels*, 3: 329–335.
- Várhegyi, G.; Jakab, E.; Antal, M. J. (1994) Is the Broido-Shafizadeh Model for Cellulose Pyrolysis True? *Energy and Fuels*, 8: 1345–1352.
- Várhegyi, G.; Szabo, P.; Antal, M. J. (1994a) Kinetics of the Thermal Decomposition of Cellulose under the Experimental Conditions of Thermal Analysis. Theoretical Extrapolations to High Heating Rates. *Biomass and Bioenergy*, 7.
- Várhegyi, G.; Szabo, P.; Antal, M. J. (1994b) Reaction Kinetics of the Thermal Decomposition of Cellulose and Hemicellulose in Biomass Materials. A: Bridgwater, A. V (ed.) *Advances in Thermochemical Biomass Conversion*. Londres: Blackie Academic and Professional, vol. 2.
- Várhegyi, G.; Szabo, P.; Jakab, E.; Till, F. (2001) Least squares criteria for the kinetic evaluation of thermoanalytical experiments. Examples from a char reactivity study. *Journal of Analytical and Applied Pyrolysis*, 57: 203–222.
- Velo, E. (1998) *Tratamiento térmico de residuos sólidos*. [Curs d'extensió universitària] Brasil: Universidad Estatal Paulista.
- Völker, S.; Rieckmann, Th. (2002) Thermokinetic investigation of cellulose pyrolysis —impact of initial and final mass on kinetic results. *Journal of Analytical and Applied Pyrolysis*, 62: 165–177.
- Ward, S. M.; Braslaw, J. (1985) Experimental Weihgt Loss Kinetics of Wood Pyrolysis under Vacuum. *Combustion and Flame*, 61: 261–269.
- Williams, P. T.; Besler, S. (1993) The Pyrolysis of Rice Husks in a Thermogravimetric Analyzer and Static Batch Reactor. *Fuel*, 72: 151.