

## Chemicals and Products from Trees

The forest industry is making great strides in using all of the tree. Lumber, plywood and paper are essential products made from the wood fiber in trees. But up to half—or even more—of a tree is lignin, the complex natural chemical that binds the fibers in the tree together. This and other “silvichemicals” from trees are used today in thousands of products important to people. This exhibit presents some of those 5000 products. The best part about silvichemicals is that we will never run out of them, because trees—unlike coal and petroleum sources of chemicals—are endlessly renewable.

Turpentine and tall oil are resinous materials reclaimed from the paper-pulping process. They are important ingredients in paint, varnish, adhesives, asphalt, lube-oil additives, resins, menthol, lacquer, camphor, printing inks, carbon paper, fungicides, rubber and latex products, soaps, disinfectants and polishes. Synthesized essential oils are used in chewing gum, mouthwash, peppermint candies and toothpaste, menthol cigarettes, lime aftershave, detergents, soaps and shampoo.

Wood flour and melamine resins using cellulose filler are principal components of dinnerware, electrical receptacles and parts, toys, caster wheels, toilet seats, handles for cooking utensils, telephone housings, camera cases, washing-machine impellers, radio and TV cabinets and other appliance housings. Wood flour and resins are also used as adhesives in the paper industry.

Ethyl cellulose and other chemical based cellulose are used in making tool handles, photographic films, packaging films, glasses frames, molded packages, combs, brush and mirror backs, sponges, acetate filament yarns, sausage casings, cellophane, knobs and handles, luggage, gunstocks, fishing floats, toothbrushes, plastic pens, football helmets and hard hats, electrical tape, coatings, lampshades and a host of other products. Acetate filament yarns from

cellulose include rayon fiber and other textile products such as clothing, drapes and rugs.

Nitrocellulose is used in making solid rocket propellants and other explosives.

Torula yeast is a high-protein product made from wood sugars spent in the pulping process. It has 17 nutritional trace elements, including four to five times the amount of iron found in uncooked spinach or raisins. Type S Torula is used in baby foods, cereals, imitation bacon, baked goods, beverages, vegetarian food and dietary preparations. Type F Torula is used in feed supplements for cattle, hogs, fish, chickens and mink, and Type FP Torula goes into pet foods. Torula has been found to make bees and lobsters grow faster.

Lignosulfonates from spent sulphite pulping liquor are used in cleaning compounds, insecticides, cement, ceramic products, oilwell drilling muds, cosmetics, artificial vanilla flavoring, gummed tape, deodorants, hair spray, certain pharmaceuticals (Aldomet and Aldoril for hypertension and L-Dopa for Parkinson's disease are examples), fungicides, fertilizer, grouting, tanning agents for leather and a static remover for laundry. Spent sulphite liquor is also used as a binder for animal feed pellets, as an extender for molasses for liquid animal feeds, for linoleum paste, road binder, and as a binder for foundry cores and ore briquettes.

From 13 to 21 percent of a cord of wood may be bark. Much of it is used as fuel in forest industry mills. Bark is also a source of papermaking fibers and chemicals such as resins, fatty acids, tannins, waxes, vitamins and tall oil. Large amounts of bark are used as mulches, soil conditioners and bedding for poultry and livestock. Other uses of bark include plywood adhesives, plastic fillers, lacquers and varnishes, molded products and oil-spill control agents.

# Wood Products...

This puzzle explores common and uncommon products from wood. Up to half—or even more—of a tree is lignin, a complex natural chemical that glues fibers in a tree together. Lignin and other silvichemicals (chemicals from trees) are used in over 5000 products. The best part about silvichemicals is we won't run out of them, because trees are renewable!

C P H O T O G R A P H I C F I L M A T O O T H P A S T E  
 E B D G M A S C E D A H S O A T L A S C I T E M S O C N  
 L C I D E R E F H O I H W O L O H O C L A E I R I P S A  
 L L K L D T I R E O R C I P P D E C O Y S M E N P L P M  
 O O S O I I V P Q R S L N M L A D H E S I V E S A Y A E  
 P C W M C F O C T S P U G A A S T U K V O I F E L W C L  
 H K A U I I M E S W R M S H T N L C X C A T I N L O E A  
 A S S G N C A M E R A C A S E V I E D Z R A R I E O C N  
 N A E G E I S E L B Y D C M S P S R S E S M E Z T D R D  
 E R E N I A T N O C K L I M H R O S I K S I L A S H A W  
 I J S I N L F T P H K L T T A C E T O N E N A G L S F O  
 K M B W O F A D G A N A O D E L A E D O V S D A L B T O  
 E R O E I L R I A R B O N R I X O R E S I N D M A I R D  
 X O O H T A P S L C T E N B F N Y Q W R T R E S B R E S  
 P O K C A V H P F O L P A O A W T U W A A T R U G C E T  
 L F S E L O A E X A C G R C A N D Y B O X Y G E N Y N A  
 O S E R U R N R C L S M S L E N N E K Z A E O A O G T I  
 S B K A S I D S N I S C L M D R E B M U L E S N P U R N  
 I D A M N N L A D I A P E R S F S K C O T S N U G M Y S  
 V I R I I G E N U T S C G A H R E P A P Y L F I N M S P  
 E C J C S U S T K L R H R F U N G I C I D E S M I E H U  
 S A D S T I U R F E R T I L I Z E R S L I C N E P D I C  
 A C E T A T E N U A P S E R U T I N R U F O B O A T E G  
 X I S P M A Q Q C E P D O O F Y B A B U T T O N S A L N  
 E T K F P R A K N A R B S D R A O B E L C I T R A P D I  
 S E S U S L S S M T M E T R O N O M E U S P O N G E S K  
 V C W E S E I D N A C T N I M R E P P E P S O A P S X A  
 R A I L R O A D T I E C A R D S K C I T S Y E K C O H B

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|-------------------------|-----------------------|--------------------|------------------------|---------------------------------|
| 1. ACETATE              | 23. CEMENT DISPERSANT | 46. GUITAR         | 69. PARTICLE BOARD     | 92. TAX FORMS                   |
| 2. ACETIC ACID          | 24. CERAMICS          | 47. GUMMED TAPE    | 70. PENCILS            | 93. TIRE                        |
| 3. ACETONE              | 25. CHARCOAL          | 48. GUNSTOCKS      | 71. PEPPERMINT CANDIES | 94. TOOTH PASTE                 |
| 4. ADHESIVES            | 26. CHEWING GUM       | 49. HAIR SPRAY     | 72. PHOTOGRAPHIC FILM  | 95. TOOTH PICKS                 |
| 5. ALCOHOL              | 27. CIDER             | 50. HANDLES        | 73. PING PONG BALLS    | 96. VARNISH                     |
| 6. ART PENS             | 28. CLOCKS            | 51. HOCKEY STICKS  | 74. PLATES             | 97. VITAMINS                    |
| 7. ARTIFICIAL FLAVORING | 29. CORK              | 52. INSULATION     | 75. PLYWOOD            | 98. WAXES                       |
| 8. ATLAS                | 30. COSMETICS         | 53. KENNELS        | 76. RACKS              | 99. SPACE CRAFT REENTRY SHIELDS |
| 9. AXES                 | 31. CRIBS             | 54. LACQUER        | 77. RAFTS              | 100. ENAMEL AND WOOD STAINS     |
| 10. BABY FOOD           | 32. DECOYS            | 55. LAXATIVES      | 78. RAILROAD TIE       | Created by W.K. Wedum 6/93      |
| 11. BAGS                | 33. DESKS             | 56. LUMBER         | 79. RAKES              |                                 |
| 12. BAKING CUPS         | 34. DIAPERS           | 57. MAGAZINES      | 80. RAYON              |                                 |
| 13. BAT (Baseball)      | 35. DOORS             | 58. MAPS           | 81. RECORD COVERS      |                                 |
| 14. BOAT                | 36. DRY WALL          | 59. MEDICINE       | 82. RESIN              |                                 |
| 15. BOOKS               | 37. EXPLOSIVES        | 60. MENTHOL        | 83. ROOFS              |                                 |
| 16. BUTTONS             | 38. FERTILIZERS       | 61. METRONOME      | 84. SEESAWS            |                                 |
| 17. CALENDARS           | 39. FIRE LADDER       | 62. MILK CONTAINER | 85. SHADE              |                                 |
| 18. CAMERA CASE         | 40. FLAG POLES        | 63. MOVIES         | 86. SHAMPOO            |                                 |
| 19. CANDY BOX           | 41. FLY PAPER         | 64. MULCH          | 87. SKIS               |                                 |
| 20. CANOE               | 42. FRUIT             | 65. NUTS           | 88. SOAPS              |                                 |
| 21. CARDS               | 43. FUEL              | 66. OARS           | 89. SPONGES            |                                 |
| 22. CELLOPHANE          | 44. FUNGICIDES        | 67. OXYGEN         | 90. STAMPS             |                                 |
|                         | 45. FURNITURE         | 68. PALLETS        | 91. SWINGS             |                                 |

