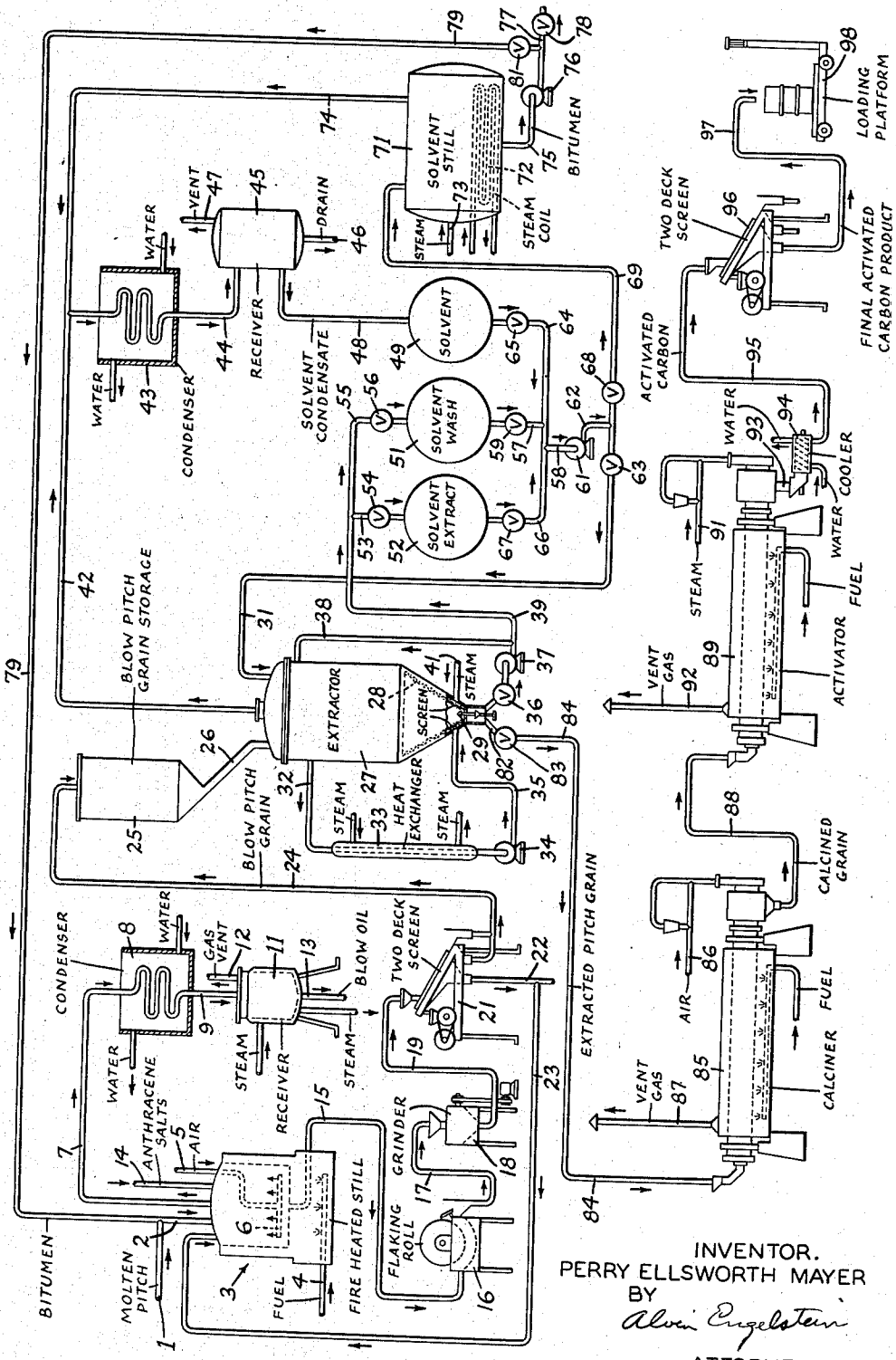
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CONVERSION OF TAR PITCHES INTO ACTIVATED CARBONS

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CONVERSION OF TAR PITCHES INTO ACTIVATED CARBONS

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This invention relates to the conversion of pitches into activated carbons and more particularly refers to a new and improved method of converting pitches derived from coal tars, water-gas tars and oil-gas tars into highly activated carbons especially adapted for decolorizing, deodorizing and for gas and vapor adsorption purposes.

An object of the present invention is to provide a method for converting pitches into uniformly-sized grain suitable for processing into activated carbons without the necessity for passing through the pulverulent state.

Another object is to provide a method for controlling the porosity of granular activated carbon produced from coal tar, water-gas tar and oil-gas tar pitches.

A further object of this invention is to provide a method for obtaining an increased yield of activated carbons from coal tar, water-gas tar and oil-gas tar pitches by converting the bitumen components normally unsuitable for production of activated carbon into additional activated carbons.

A still further object is to provide an efficient economical process for converting coal tar, water-gas tar and oil-gas tar pitches into high yields of strong granular highly active carbons.

Other objects and advantages of the present invention will be apparent from the following description and the accompanying drawing.

A preferred method for the conversion of coal tar, water-gas tar and oil-gas tar pitches in accordance with the present invention comprises passing air or other oxygen-containing gases such as flue gases containing oxygen, flue gas-air mixtures, and steam-air mixtures, in intimate contact with molten pitch, continuing the passage of air in contact with the molten pitch until the pitch has a benzol-insoluble content in excess of 45%, preferably within the range of 45–65%, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size, preferably within the range of 4 to 50 mesh, extracting benzol-soluble components from the pitch granules by contacting the pitch granules with a solvent, preferably a predominantly aromatic liquid or a constituent thereof such as benzol, toluol and xylol, heating the extracted granules in a stream of oxygen-containing gas, preferably air, to a temperature within the range of about 200 to 400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the char by the action of steam or flue gases.

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The solvent containing dissolved benzol-soluble components (bitumen) resulting from leaching the pitch granules may be subjected to distillation for separation into purified solvent and bitumen. The bitumen may be withdrawn from the still for use as such, or if desired, may be recharged to the blow still for additional oxidation and ultimate conversion into activated carbon.

If desired, the benzol-insoluble content of the air-blown pitch may be reduced by blending with compatible hydrocarbon materials of lower insoluble content, a procedure which is particularly useful if the pitch shall have been blown to a benzol-insoluble content in excess of 65%. Suitable fluxes for this purpose would be, for example, normal pitches obtained by direct distillation of the tars, soluble bitumens recovered from the extraction of the air-blown pitch, heavy distillate oils or the "salt" components which crystallize out of creosote oil and other heavy coal-tar distillates. The blend of molten pitch and flux is cooled, ground, solvent extracted, calcined and activated in the manner described above.

The accompanying drawing diagrammatically illustrates a preferred operation of the present invention when air blowing is used to increase the benzol-insoluble content of the pitch. Referring to the drawing, coal tar pitch or water-gas tar pitch or oil-gas tar pitch or mixtures thereof are introduced through lines 1 and 2 into fire heated still designated by numeral 3. For convenience in operation the pitch is desirably heated to a liquid state prior to introduction in fire heated still 3 and maintained therein in a molten condition at a temperature of about 300–400° C. by burning fuel introduced through line 4 at the bottom of the still. Air is blown through conduit 5 connecting to crosspipe 6 which latter has a series of small orifices through which the air rises upwardly, as indicated by the arrows, in intimate contact with the body of molten pitch in still 3. As a result of the passage of air or other oxygen-containing gas the benzol-insoluble content of the molten pitch increases. Air is blown through the molten pitch until it has a benzol-insoluble content in excess of 45%; best results are obtained with the pitch having a benzol-insoluble content within the range of 45–65%. As will be explained later, the resultant air-blown pitch is solidified, ground to granular size and the granules subjected to extraction with solvent for removing the major portion of the benzol-soluble constituents from the granules. If the granules contain an amount of benzol-insoluble constituents appreciably lower

than 45% the granules after leaching with the solvent will be structurally weak and subject to attrition and deterioration into fines, whereas if the granules contain an amount of benzol-insoluble components appreciably greater than 65% the leached granules will be less porous and less suceptible to activation treatment to activated carbons.

The length of time required to raise the benzol-insoluble content of the molten pitch to within the range of 45–65% will vary dependent upon the rate of air flow, temperature and nature of the individual pitch undergoing treatment. In general about 3 to 8 hours are required to raise the bonzol-insoluble content of the pitch to the desired value, when blowing pitch with air at a rate of 30 cubic feet per minute per ton of pitch at a temperature of e. g. 350°–400° C.

During the air blowing of the molten pitch, evolved gases and vapors are released from the top of still 3 through line 7, pass through water cooled condenser 8 to liquefy the vapors, and the cooled gas and condensate flow through line 9 to be collected in steam jacketed receiver 11. Non-condensable gases are released from receiver 11 through gas vent line 12. Condensate comprising hydrocarbon oils, designated generally in the industry as blow oil, collected in the bottom of receiver 11 is discharged through line 13 for use as fuel or other disposition. To avoid plugging of line 13 due to the crystallization of high boiling hydrocarbon constituents in the blow oil a steam jacket, as clearly shown in the drawing, surrounds receiver 11 for heating and maintaining the blow oil in liquid condition.

In a modified method of operation air may be blown through line 5 into the molten body of pitch contained in still 3 until the benzol-insoluble content of the pitch is in excess of 65%, for example 75%. Upon cooling, grinding and leaching of such high benzol-insoluble pitch the resultant granules may not have the desired porosity and may be difficult to activate to a high quality activated carbon. Therefore, a compatible hydrocarbon flux of substantially lower benzol-insoluble content such as normal residual pitch, extracted bitumen, heavy distillate oil, or anthracene salts is added through line 14 to the molten air-blown pitch, blending therewith and reducing the benzol-insoluble content of the resulant fluxed pitch to within the range of 45–65%.

Thus, by the addition of regulated amounts of, e. g. anthracene salts to the air-blown pitch, the porosity of the carbon granules may be controlled, and further this addition permits extended air blowing of the molten pitch to a high benzol-insoluble content. Anthracene salts, a common product of the coal tar industry, comprise the crystalline phase which separates out on cooling coal tar distillates boiling within the range of about 250–400° C. Anthrancene salts, which are soluble in benzol, comprise mixed crystals of anthracene, phenanthrene, carbazole, acenaphthene and other aromatic hydrocarbon compounds and occluded oils. The molten air-blown pitch-anthracene salts blend is solidified, ground to granular size and leached with solvent to remove the anthracene salts. The anthracene salts may be separated from the solvent and reused.

After the molten pitch has been air blown to the desired benzol-insoluble content the pitch while in fluid condition is discharged from fire heated still 3 through line 15 onto conventional flaking roll 16 where it is cooled and solidified. Cooling and solidification of the molten pitch may also be accomplished by discharging pitch into a pitch bay or into a tank containing water or the solvent to be used for the ultimate extraction. Fine streams of molten pitch may be cooled by quenching in water or solvent to produce solid pitch in the form of granules suitable for preparation of activated carbon grain without the necessity of crushing and sizing the air-blown pitch. In the embodiment shown in the drawing the solid pitch from flaking roll 16 passes via line 17 to conventional grinder 18 wherein it is crushed to form granules of about 4 to 50 mesh size with, as usual, the formation of a minor amount of fines and a small amount of oversized particles. The crushed pitch passes through line 19 to a conventional two-deck screen 21 for the purpose of separating out the fines and oversized particles, which latter may be returned to grinder 18 for further crushing. The separated fines may be discharged from the system through line 22, or preferably are returned through line 23 to fire heated still 3 in admixture with the molten pitch and thus are ultimately recovered in the form of the desired carbon granules thereby eliminating a waste product and enhancing the yield of activated carbon.

The screened granules designated as blow pitch grain are transferred via line 24 to blow pitch grain storage 25, a hopper, from which the blow pitch grain is fed through conduit 26 into extractor 27. Extractor 27 as shown in the drawing may be a cylindrical vessel with a conical bottom having the screen 28 on which the blow pitch grain rests inside the base of extractor 27. An opening at the bottom of screen 28 provided with valve 29 permits the discharge of blow pitch grain after solvent extraction.

The blow pitch grain is subjected to solvent extraction to remove benzol-soluble constituents from the grain thereby producing a structurally strong highly porous grain having an increased benzol-insoluble content without loss of particulate identity of the grain. Extraction of benzol-soluble constituents from the grain may be conveniently carried out by filling extractor 27 about one-half full with blow pitch grain, then adding sufficient aromatic solvent through line 31 to completely cover the grain. To facilitate extraction, the solvent may be heated to about 25–110° C. by circulating it from extractor 27 through line 32, thence in indirect contact with steam in heat exchanger 33, and then by pump 34 through line 35 into the bottom of extractor 27. Additional temperature control and more efficient contact with the blow pitch grain may be obtained by circulating a portion of the solvent from the bottom of extractor 27 through line 36 and forcing it by pump 37 through line 38 to the top of extractor 27. By thus maintaining rapid circulation of the solvent through the bed of grain on screen 28, it was found unnecessary to employ mechanical stirring or agitating devices. After digesting the grain with solvent for about one hour the liquor is withdrawn from the bottom of extractor 27 through line 36 and forced by pump 37 through line 39 to storage tanks. Fresh solvent may then be charged into extractor 27 for a second and third leaching similar to the first extraction. Ordinarily, three batchwise solvent leachings as just described will be adequate to remove most of the benzol-soluble components from the blow pitch grain. At the end of the solvent extractions liquid remaining in extractor 27 is drained through line 36 and the solvent remaining on the grain is removed by

passing steam introduced through line 41 upwardly through the grain. Steam and solvent vapors are released from the top of extractor 27 through line 42, cooled in water condenser 43 and the cooled products passing through line 44 collected in receiver 45. Water may be drained from the bottom of receiver 45 through line 46. Incondensable gases are released from the top of receiver 45 through vent line 47. Solvent condensate withdrawn from receiver 45 is returend through line 48 to solvent tank 49 for further use.

As will be noted three solvent tanks numbered 49, 51 and 52 are provided with suitable manifolding to permit them to be used interchangeably. Ordinarily, the liquor from the first washing of the grain in extractor 27 will be directed by pump 37 through lines 36, 39, 53 and valve 54 into solvent extractor tank 52. Liquor containing less dissolved benzol-soluble components from the second and third leachings will be directed to solvent wash tank 51 via lines 39, 55 and valve 56. In some cases the liquor in tank 51 from the second or third washings of the grain may be satisfactory for reuse without preliminary purification of the liquor as the solvent for the first leaching of a subsequent batch of grain in which event solvent is withdrawn from tank 51 through lines 57, 58 and valve 59 and directed by pump 61 through line 62, valve 63 and line 31 into extractor 27. As is apparent from the drawing fresh solvent from tank 49 passes through line 64, valve 65, line 58 and is forced by pump 61 through lines 62, 31 and valve 63 into extractor 27. Impure solvent, i. e. solvent containing dissolved bitumen from previous leachings of blow pitch grain in extractor 27 may be periodically withdrawn from solvent wash tank 51 through line 57 and valve 59 and solvent extract tank 52 through line 66 and valve 67 and thence through line 58 to be forced by pump 61 through line 62, valve 68, line 69 into solvent still 71 which may be any conventional still commonly employed in the industry for steam distilling solvent. Heat is applied to solvent still 71 by means of enclosed steam coil 72, and in addition to facilitate vaporization of the solvent, steam is introduced through line 73 in direct contact with the liquid in the still. Vapors comprising substantially pure solvent and water evolved from solvent still 71 are released through line 74, cooled in condenser 43, thence discharged through line 44 into receiver 45 from which the solvent condensate is withdrawn through line 48 and collected in solvent tank 49 for further use. Bitumen extracted from the pitch, benzol-soluble constituents, remaining as residue in solvent still 71, is withdrawn from the bottom of the still through line 75 and directed by pump 76 through line 77 and valve 78 to storage for use as fuel or other disposition, or preferably the bitumen is returned through line 79 and valve 81, thence through line 2 into fire heated still 3 wherein the bitumen in admixture with molten pitch entering through line 1 is air blown into additional yields of pitch suitable for activation.

After the blow pitch grain has been adequately leached to remove the benzol-soluble constituents therefrom, steamed free of solvent and, if desired, dried by passing warm air through the bed, valve 29 adjacent the bottom of screen 28 of extractor 27 is opened and the porous grain discharged through line 82 and valve 83 and directed via line 84 into calciner 85 which may be an externally heated rotary retort provided with an inlet 86 at one end for the introduction of air or oxygen-

containing gas and a discharge line 87 at the other end for the release of waste gas. The grain in calciner 85 is heated to a temperature below 200° C. and an air stream at the rate of about 1.5 to 7.5 cubic feet per minute per 100 pounds of grain continuously introduced through line 86 in direct contact with the heated grain. The temperature of the grain is gradually increased while continuously passing air in contact therewith until the grain reaches a temperature not to exceed about 400° C. The rate of calcination is controlled to avoid fusion of the grain. Ordinarily, heating for about 6 hours will produce an infusible grain with the elimination of fusible residues.

The infusible grains are transferred via line 88 into activator 89 which may also be an externally heated retort provided with an inlet 91 for the introduction of an activating gas such as steam or flue gases and a vent gas line 92 at the other end for the discharge of gases from activator 89. Temperature of the order of 900–1200° C. are employed to effect activation of the grain in activator 89 as is conventional in the art. The hot activated carbon grains are discharged from activator 89 through line 93, cooled by indirect heat exchange with water in cooler 94 and the cooled grain discharged via line 95 to conventional two-deck screen 96 for removal of any small amounts of fines or oversized particles, and the granular activated carbon product discharged from two-deck screen 96 through line 97 to loading platform 98 for shipment.

If it be desired to produce activated carbon for use in decolorizing liquid media it is simply required that the granular end product be pulverized to, for example, 80% passing a No. 325 sieve, prior to packaging.

If desired, other processes such as sulfurization, chlorination, reaction with oxidizing agents such as ammonium sulfate, solvent extraction, etc., may be used to increase the benzol-insoluble content of the pitch to within the preferred range prior to granulation, but air-blowing is economical and effective and, therefore, preferred. If the pitch charged to the process be above 45% in benzol-insoluble content (e. g., a residuum from horizontal retort tar) the solid pitch may be fed directly to the granulator for processing.

The following examples illustrate the present invention for the conversion of pitch into granular activated carbons:

Example 1

A coal tar pitch having a melting point of 90° C. and containing 28% benzol-insoluble constituents was heated to 375° C. and maintained at that temperature during which time air at the rate of 1.0 cubic foot per minute per 100 pounds of pitch was blown through the body of molten pitch. At the end of 4¼ hours the benzol-insoluble content of the pitch increased to 57%. The air-blown pitch while still in a fluid state was solidified on a flaking roll and then crushed to 10–50 mesh size grain. This grain was digested batchwise at 100° C. for one hour with sufficient xylol to completely cover the bed of grain. Two additional similar solvent extractions of the grain with fresh xylol were made leaving a porous grain analyzing 80.6% benzol-insoluble. The grain was steamed to eliminate solvent therefrom and then air dried. The solvent extracted grain was then heated from a temperature below 200° C. to a temperature of 375° C. in an air stream of 2 cubic feet per minute per 100 pounds

of grain for a period of 6 hours. The calcined grain was then activated at 975° C. with steam to produce a highly active carbon. The activated carbon product was of such activity that 0.25 gram removed 88% of the iodine from the standard solution.

Example 2

Coal tar pitch from the same source as used in Example 1 together with 15% by weight of bitumen (benzol-soluble constituents separated from solvent utilized in extracting air-blown pitch) was heated to 375° C. and air passed through the molten mixture until it contained 54½% benzol-insolubles. The air-blown pitch was solidified on a flaking roll, crushed, solvent extracted, calcined and activated with steam in the same manner as described in Example 1. The final activated carbon was a strong carbon grain which had an iodine value of 85%.

Example 3

Pitch from the same source as Example 1 was air blown for a period of about 7 hours to increase the benzol-insoluble content of the pitch to 72%. 20% anthracene salts were added to the molten air-blown pitch to give a benzol-insoluble content of 57%. The resultant mixture was solidified in a pitch bay and crushed to grain of 6–14 mesh size. The grain was extracted in three batch-wise operations with xylol, steamed to eliminate solvent therefrom and then air dried, thereby producing extracted grain having a benzol-insoluble content of 86% and a bulk density of 0.630 gram per cc. The extracted grain was then calcined in the presence of air by gradually heating to 450° C. and then activated with steam at 1000° C. The thus produced grains of activated carbon had an iodine value of 90% and a bulk density of 0.390 gram per cc.

Example 4

Water-gas tar pitch of 200° F. melting point was air blown for 4 hours at 400° C. using 1 cc. air per gram per minute. The product had a benzol-insoluble content of 57%. After granulating to 10–20 mesh, the pitch was extracted with xylol, steam-stripped of solvent and dried. Calcination with air for 4½ hours within the range of 200 to 400° C. was followed by steam activation at 975° C. The product had an iodine value of 88%.

Example 5

A water-gas tar pitch having a melting point of 167° C. and containing 20% benzol-insoluble constituents was heated to 375° C. and air blown for 6 hours to increase the benzol-insoluble content to 52%. The molten pitch was discharged from the blowing still into a pitch bay and allowed to cool. The solid pitch was crushed, sized by screening to 8–32 mesh; solvent extracted in 5 leaches using counter-current procedures, the first contact conducted at 50° C. with used solvent extract containing 7% of bitumen and the final contact made at 110° C. with distilled solvent; calcined and activated with steam in the same manner as described in Example 1. The final activated carbon was a strong carbon grain, substantially all passing 10 mesh and retained on 48 mesh and having a bulk density of 28 pounds per cubic foot with an iodine value of 88.5%.

Example 6

Air blown coke-oven pitch of 65% benzol-insoluble content was blended with a conventional coke-oven tar pitch of 217° F. melting point having 32% benzol-insolubles, the proportions being 80 parts of the blown pitch to 20 of the straight run. The resultant blend analyzed 58% insolubles. After crushing to a 10–20 mesh grain, the pitch was extracted with xylol as in previous examples, calcined and activated. The activated grain was strong and hard and had an iodine value of 80%.

Example 7

Coal-tar pitch from the same source as used in Example 1 was heated to 400° C. and maintained at that temperature while air blowing for a period of 7½ hours. The benzol-insoluble content of the pitch increased to 72%. Molten bitumen, obtained by solvent distillation from prior air-blown pitch extract, was added to the air-blown pitch in sufficient quantity to reduce the benzol-insoluble content to 50%. The air-blown pitch blend was discharged to a pitch bay, cooled, crushed, solvent extracted, calcined, and activated as described in Example 1 to produce a strong granular activated carbon.

Example 8

A residuum obtained by distillation of oil-gas tar had a melting point of 125° C. and analyzed 42% insoluble in benzol. After air blowing for 10 hours at 375°–400° C. with 1 cubic foot per ton per hour of air, the benzol-insoluble content had increased to 64.8%. This blown pitch was granulated to 10–20 mesh and extracted with xylol to give an extracted grain which, after solvent elimination and drying, analyzed 95% benzol-insoluble. After calcination in air by the procedure used in Example 1, the grain was steam activated at 975° C. to a product having a bulk density of 0.340 gram per cubic centimeter and an iodine value of 88%.

Example 9

A blend comprising 35 parts of coke-oven tar pitch (melting point 296° F.), 15 parts of bitumen recovered from extracts from air-blown pitch and 12.5 parts of "fines" resulting from the crushing of air-blown pitch was blown with air at 375° C. for 5 hours. The air-blown product, which analyzed 50% benzol-insoluble, was crushed and graded to pass a No. 8 sieve and be retained on a No. 24 sieve. The grain was extracted with solvent, steamed and dried, after which it was calcined in air at 200° to 400° C. and finally steam activated at 1050° C. The resultant product was pulverized and evaluated as a sugar decolorizing carbon. 0.5 gram of this carbon removed 93.6% of the color from a standard brown sugar solution. A highly active commercial decolorizing carbon removed 92% of the color from this same solution.

Coal tar and coal-tar pitch derived therefrom are heavy hydrocarbons which may be termed a pyrogenous hydrocarbon condensate resulting from the destructive distillation of coals. Water-gas tar and water-gas tar pitch derived therefrom and oil-gas tar and oil-gas tar pitch derived therefrom are heavy hydrocarbons which may be termed a pyrogenous hydrocarbon condensate resulting from the pyrolysis of petroleum at high temperature to produce predominantly gas.

The term "bitumen" as used in the appended claims shall mean the benzol-soluble components leached from the air-blown pitch in the solvent extraction operation and subsequently recovered from the solvent extract as a distillation residue.

The term "hydrocarbon flux" as used in the appended claims shall mean a compatible hydrocar-

bon material of the lower benzol-insoluble content than the air-blown pitch with which it is blended. Examples of suitable fluxes are normal pitches obtained by direct distillation of the tars, soluble bitumen recovered from the extraction of the blown pitch, heavy distillate oils, and salt components which crystallize out of creosote oil and other heavy coal-tar distillates.

Although certain preferred embodiments of the invention have been disclosed for purpose of illustration it will be evident that various changes and modifications may be made therein without departing from the scope and spirit of the invention.

I claim:

1. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with a molten pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch until said pitch has a benzol-insoluble content in excess of 45% and less than 65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling and reducing resultant molten pitch to solid form of granular size of between about 4–50 mesh, contacting the pitch granules with a solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules at regulated temperatures below the fusion point of the granules in the presence of oxygen-containing gas until an infusible activatable granular char is obtained.

2. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with a molten mixture of a pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch, and benzol-soluble components leached from air-blown pitch until said mixture has a benzol-insoluble content in excess of 45% and less than 65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling and reducing the resultant molten mixture to solid form of granular size of between about 4–50 mesh, contacting the granules with a solvent to extract the benzol-soluble components thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules at regulated temperatures below the fusion point of the granules in the presence of oxygen-containing gas until an infusible activatable granular char is obtained.

3. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with a molten pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch until said pitch has a benzol-insoluble content in excess of 65% by weight, blending a hydrocarbon flux with the gas-treated molten pitch thereby producing a mixture having a reduced benzol-insoluble content of between 45–65%, thereafter and in sequence and without passing through the pulverulent state, cooling and reducing the molten mixture to solid form of granular size of between about 4–50 mesh, contacting the granules with a solvent to extract the benzol-soluble components thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules at regulated temperatures below the fusion point of the granules in the presence of oxygen-containing gas until an infusible activatable granular char is obtained.

4. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with a molten pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch until said pitch has a benzol-insoluble content in excess of 65% by weight, admixing anthracene salts with the gas-treated molten pitch thereby producing a mixture having a reduced benzol-insoluble content of between 45–65%, thereafter and in sequence and without passing through the pulverulent state, cooling the mixture to solid form, grinding the solid to granular size of between 4–50 mesh, contacting the granules with a solvent to extract the benzol-soluble components thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules at regulated temperatures below the fusion point of the granules in the presence of oxygen-containing gas until an infusible activatable granular char is obtained.

5. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with molten coal-tar pitch until said pitch has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size to within the range of about 4–50 mesh, contacting the pitch granules with a solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules in a stream of oxygen-containing gas to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition.

6. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate contact with molten water-gas tar pitch until said pitch has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size to within the range of about 4–50 mesh, contacting the pitch granules with a solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules in a stream of oxygen-containing gas to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition.

7. A process for the conversion of pitch into granules of activatable char which comprises passing an oxygen-containing gas in intimate

contact with molten oil-gas tar pitch until said pitch has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size to within the range of about 4–50 mesh, contacting the pitch granules with a solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, and heating the resultant granules in a stream of oxygen-containing gas to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition.

8. A process for the conversion of pitch into granular activated carbon which comprises passing a stream of air in intimate contact with a molten pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch maintained at a temperature of about 300–400° C. until said pitch has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size to within the range of about 4–50 mesh, screening and separating the oversize and undersize particles from the ground pitch, leaching the pitch granules within the range of about 4–50 mesh size with a predominantly aromatic liquid solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, heating the resultant granules in the stream of air to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the granular infusible char to produce activated carbon.

9. A process for the conversion of pitch into granular activated carbon which comprises passing a stream of air in intimate contact with a molten mixture of a pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch, and benzol-soluble components leached from air-blown pitch, maintained at a temperature of about 300–400° C. until said mixture has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten mixture to solid form, grinding the solid to granular size to within the range of about 4–50 mesh, screening and separating the oversize and undersize particles from the ground solid, leaching the granules within the range of about 4–50 mesh size with a predominantly aromatic liquid solvent to extract the benzol-soluble components from the granules thereby producing highly porous granules without loss of particulate identity of the granules, separating the dissolved benzol-soluble constituents from the solvent, returning the separated benzol-soluble constituents for admixture with additional pitch for conversion into activated carbon, heating the granules after leaching with solvent in a stream of air to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the granular infusible char to produce activated carbon.

10. A process for the conversion of pitch into granular activated carbon which comprises passing a stream of air in intimate contact with molten pitch selected from the group consisting of coal-tar pitch, water-gas tar pitch and oil-gas tar pitch maintained at a temperature of about 300–400° C. until said pitch has a benzol-insoluble content within the range of 45–65% by weight, thereafter and in sequence and without passing through the pulverulent state, cooling the resultant molten pitch to solid form, grinding the solid pitch to granular size to within the range of about 4–50 mesh, screening and separating the oversize and undersize particles from the ground pitch, returning the undersize particles in admixture with additional coal-tar pitch to be subjected to the action of a stream of air, leaching the pitch granules within the range of about 4–50 mesh size with a solvent to extract the benzol-soluble components from the pitch granules thereby producing highly porous granules without loss of particulate identity of the granules, heating the resultant granules in a stream of air to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the granular infusible char to produce activated carbon.

11. A process for the conversion of pitch into granular activated carbon which comprises passing a stream of air in intimate contact with molten coal-tar pitch maintained at a temperature of about 300–400° C. until said pitch has a benzol-insoluble content in excess of 65% by weight, blending anthracene salts with said air-blown molten pitch in an amount sufficient to reduce the benzol-insoluble content of the mixture to within the range of 45–65% by weight, cooling the resultant mixture to solid form, grinding the solid to granular size to within the range of about 4–50 mesh, screening, and separating oversize and undersize particles from the ground mixture, leaching the granules within the range of about 4–50 mesh size with a predominantly aromatic liquid solvent to extract the benzol-soluble components from the granules thereby producing highly porous granules without loss of particulate identity of the granules, heating the resultant granules in a stream of air to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the granular infusible char to produce activated carbon.

12. A process for the conversion of pitch into granular activated carbon which comprises passing a stream of air in intimate contact with molten water-gas tar pitch maintained at a temperature of about 300–400° C. until said pitch has a benzol-insoluble content in excess of 65% by weight, blending anthracene salts with said air-blown molten pitch in an amount sufficient to reduce the benzol-insoluble content of the mixture to within the range of 45–65% by weight, cooling the resultant mixture to solid form, grinding the solid to granular size to within the range of about 4–50 mesh, screening and separating oversize and undersize particles from the ground mixture, leaching the granules within the range

of about 10–50 mesh size with a predominantly aromatic liquid solvent to extract the benzol-soluble components from the granules thereby producing highly porous granules without loss of particulate identity of the granules, heating the resultant granules in a stream of air to a temperature within the range of about 200–400° C. until an infusible activatable char is obtained, regulating the temperature during such heating so that the granules remain in an unfused condition, and activating the granular infusible char to produce activated carbon.

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