FRONTISPIECE: Influenza (the “flu”) spreads around the world annually, killing millions of people in pandemic years and hundreds of thousands in non-pandemic years. Three such pandemics occurred in the 20th century and killed tens of millions of people. A deadly avian strain (the “bird” flu), H5N1, poses the greatest risk for a new influenza pandemic since it first killed humans in Asia in the 1990s.
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Reviews and Monographs


Natural-Product Humic Acid


J. D. Ritchie and E. M. Perdue. Predicting the most probable distribution of acidic functional groups in natural organic matter. In *Book of Abstracts, 38th ACS Middle Atlantic Regional Meeting*; Hershey, Pennsylvania: American Chemical Society, **2006**; MRM-531.


(4458) A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* 2007, 40(2 & 3), 125-146.


(4547) J. Liu, B. Xing, and X. Han. Method for obtaining a series of samples of humic acid and humin from soil. CN 1,718,615 (January 11, 2006).


(4591) A. A. Stepanov. Structures of amphiphilic humic acid fractions from southern chernozem. Pochvovedenie 2005, (8), 955-959.


V. V. Dobrovol’skii. Humic acids and aqueous migration of heavy metals. *Pochvovedenie** 2006**, (11), 1315-1321.


(4679) W. Guo. High-efficiency method for preparing fulvic acid by fermentation. CN 1,706,880 (December 14, 2005).


**Isolation and Preparation Procedures**


-43-


A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* **2007**, 40(2 & 3), 125-146.


J. Liu, B. Xing, and X. Han. Method for obtaining a series of samples of humic acid and humin from soil. CN 1,718,615 (January 11, 2006).


(4567) B. S. Kwon. Composition comprising extract or fraction isolated from Russian mumie to activate immunity. KR 2004/085,226 (October 8, 2004).


(4740) N. Fang. Process for production of coal humic acid for lead storage battery. *CN* 1,663,987 (September 7, 2005).


(4743) A. M. Rizzuti, D. D. Nguyen, and A. D. Cohen. Using gas chromatography with solid-phase microextraction to evaluate peats for their capacities to extract methyl tertiary butyl ether from contaminated water. In Book of Abstracts, 231st ACS National Meeting; Atlanta, Georgia: American Chemical Society, 2006; CHED-867.


(4746) Y. Nie, Y. Xu, and D. Yue. Method for treating domestic garbage landfill leachate. CN 1,669,958 (September 21, 2005).


(4748) Z. Wang. Sodium and potassium humate recovery from brown coal and peat with enhanced resistance to hard water. CN 1,594,338 (March 16, 2005).


A. G. Dvoryanidov. Method for removal of manure and processing the same into humic fraction. RU 2,294,095 (February 27, 2007).


H. Ninnemann. Structural characteristics of N-modified brown coals under special consideration of the humic substances. *Metadata Internet Doc. (Ger. Diss.)* 2007, (D0327-1).


(4840) A. R. Sardashti and M. M. Moaarof Doost. Study of the distribution equilibrium of Zn$^{2+}$ on humic acid extracted from soil of Naharkhoran in Gorgan at different pH values and determination of the equilibrium constant ($K_{eq}$) by flame atomic absorption. *Ulum Payah Danish. Al-Zahra* 2005, 18(1), 30-36, 63.

Synthetic Humic Acid


Chemical Synthesis


**Enzymatic Synthesis**

(4679) W. Guo. High-efficiency method for preparing fulvic acid by fermentation. CN 1,706,880 (December 14, 2005).

Physicochemical Properties and Characterization


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Atomic Absorption Spectroscopy (AAS)

(4840) A. R. Sardashti and M. M. Moaarof Doost. Study of the distribution equilibrium of Zn$^{2+}$ on humic acid extracted from soil of Naharkhoran in Gorgan at different pH values and determination of the equilibrium constant ($K_{eq}$) by flame atomic absorption. *Ulum Payah Danish. Al-Zahra* 2005, 18(1), 30-36, 63.

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**Capillary Electrophoresis-Gel Permeation Chromatography (CE-GPC)**


**Capillary Electrophoresis-Inductively Coupled Plasma Spectroscopy-Mass Spectrometry (CE-ICP-MS)**


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K. M. Elkins and M. A. Dickerson. Fluorescence characterization of the interaction of Al(III) and Er(III) with Suwannee River fulvic acid in the absence and presence of the herbicide 2-(2,4-dichlorophenoxy)-propionic acid. In *Book of Abstracts, 58th ACS Southeast Regional Meeting*; Augusta, Georgia: American Chemical Society, 2006, SRM06-187.


(4870) X. Xue, Y. Li, F. Zha, and P. Duan. Method for preparing separating agent of oil sand and asphaltenes with natural humic acid. CN 1,884,345 (December 27, 2006).


**with Metals**


(4458) A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* 2007, 40(2 & 3), 125-146.


V. V. Dobrovol'skii. Humic acids and aqueous migration of heavy metals. Pochvovedenie 2006, (11), 1315-1321.


(4840) A. R. Sardashti and M. M. Moaarof Doost. Study of the distribution equilibrium of Zn^{2+} on humic acid extracted from soil of Naharkhoran in Gorgan at different pH values and determination of the equilibrium constant (K_{ex}) by flame atomic absorption. *Ulum Payah Danish. Al-Zahra* **2005**, *18*(1), 30-36, 63.


(4865) K. M. Elkins and M. A. Dickerson. Fluorescence characterization of the interaction of Al(III) and Er(III) with Suwannee River fulvic acid in the absence and presence of the herbicide 2-(2,4-dichlorophenoxy)-propionic acid. In *Book of Abstracts, 58th ACS Southeast Regional Meeting*; Augusta, Georgia: American Chemical Society, **2006**; SRM06-187.


<table>
<thead>
<tr>
<th>Reference</th>
<th>Authors</th>
<th>Title</th>
<th>Journal/Conference Details</th>
</tr>
</thead>
</table>


M. Eita. Interaction of humic acid with clay mineral model surfaces in the presence and absence of Gd$^{3+}$: a study comprising QCM-D, ellipsometry and XPS. *Metadata Internet Doc. (Ger. Diss.)* **2007**, *D0618-2*.


E. Tipping. Modeling the interactions of Hg(II) and methylmercury with humic substances using WHAM/Model VI. *Appl. Geochem.* **2007**, *22*(8), 1624-1635.


E.-j. Song, D. Zhang, and Y. Guo. Determination of Cr(VI) and Cr(III) in passivation film of chromate by flame atomic absorption spectroscopy combined with separation and concentration using humic acid resin. *Cailiao Baohu* 2007, 40(7), 82-83.


(5075) I. Perminova. Preparation of humic acid metallic compounds, compositions containing them and uses of said compounds. *WO* 2005/042,551 (May 12, 2005).


(5089) Q. Wang and S. Wei. The stability and thermodynamics of the coordination reaction of humic acid with Fe$^{3+}$ ion. *Huanjing Kexue Xuebao* **2006**, *26*(1), 118-123.


(5096) A. G. B. Williams. Spectroscopic observations of iron oxides precipitated with humic material and the effect on heavy metal adsorption. In *Preprints of Extended Abstracts, 231*st ACS National Meeting; Atlanta, Georgia: American Chemical Society, 2006; *46*(1), 165-168.


(5133) V. Kazpard, B. S. Lartiges, C. Frochot, J. B. d'Espinose de la Caillerie, M. L. Viriot, J. M. Portal, T. Goerner, and J. L. Bersillon. Fate of coagulant species and conformational effects during the aggregation of a model of a humic substance with Al


**Composition**


(4591) A. A. Stepanov. Structures of amphiphilic humic acid fractions from southern chernozem. Pochvovedenie 2005, (8), 955-959.


**Copolymerization**


G. Fan. Super water-absorbent resin containing humic acid or salts. *CN* 1,637,075 (July 13, 2005).


W. Bentlage. Straw substitute containing superabsorbent for hoofed animals. *DE* 20/2005/007,297 (September 1, 2005).


**Critical Micelle Concentration (CMC)**


**Crosslinking**


G. Yang, Z. Li, J. Sun, L. Cui, S. Peng, Y. Cui, and H. Li. Production of a compound multifunctional water-retention agent for use in agriculture. *CN* 1,580,186 (February 16, 2005).


**Decolorization**


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Density

(4411) E. Dinar, T. F. Mentel, and Y. Rudich. The density of humic acids and humic like substances (HULIS) from fresh and aged wood burning and pollution aerosol particles. Atmos. Chem. Phys. 2007, 6(12, Pt. 3), 5213-5224.

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**Differential Thermal Analysis (DTA)**


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(4886) V. A. Konchits, V. F. Ladonin, and A. M. Aliev. Thermographic characterization of humus and humic acids from sod-podzolic soil treated with herbicides under different fertilizing systems. Agrokhimiya 2005, (10), 64-70.


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**Electron Spectroscopy for Chemical Analysis (ESCA)**


Electron Spin Resonance Spectroscopy (ESR)


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(4647) V. V. Dobrovol’skii. Humic acids and aqueous migration of heavy metals. *Pochvovedenie* 2006, (11), 1315-1321.


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(4458) A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* **2007**, **40**(2 & 3), 125-146.


**Gas Chromatography-Mass Spectrometry (GC-MS)**


**Gel-Permeation Chromatography (GPC)**


(4458) A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* **2007**, 40(2 & 3), 125-146.


**Gel-Permeation Chromatography-Inductively Coupled Plasma Spectroscopy-Mass Spectrometry (GPC-ICP-MS)**


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(5260) Y. Feng, Q. Yu, D. Luo, and T. Li. Preparation of humic acid bonded silica gel. CN 101,007,266 (August 1, 2007).


**Inductively-Coupled Plasma Spectroscopy–Mass Spectrometry (ICP–MS)**


**Infrared Spectroscopy (IR)**


(4458) A. Singh and S. K. De. I.R. absorption spectra (and their characteristics) of α- and β-humic acid extracted from entisol soil treated with fly ash and gypsum at 40% and 70% moisture and 30 days time of reaction. *Indian J. Agric. Chem.* **2007**, 40(2 & 3), 125-146.


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(4234) P. G. Hatcher. New frontiers in understanding the origin and composition of humic substances with advanced analytical methods. In *Book of Abstracts, 229th ACS National Meeting*; San Diego, California: American Chemical Society, **2005**; GEOC-42.


**Molecular Weight**


E. Dinar, T. F. Mentel, and Y. Rudich. The density of humic acids and humic like substances (HULIS) from fresh and aged wood burning and pollution aerosol particles. Atmos. Chem. Phys. 2007, 6(12, Pt. 3), 5213-5224.


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(4234) P. G. Hatcher. New frontiers in understanding the origin and composition of humic substances with advanced analytical methods. In *Book of Abstracts, 229th ACS National Meeting*; San Diego, California: American Chemical Society, **2005**; GEOC-42.


A. A. Stepanov. Structures of amphiphilic humic acid fractions from southern chernozem. Pochvovedenie 2005, (8), 955-959.


**Optical Properties**


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**Ozonation**


(5255) M. Wessling, R. Jansen, and A. Zwijnenburg. Membrane contactor based ozonation of humic substances. PMSE Prepr. 2006, 95, 967-969.


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(4647) V. V. Dobrovol'skii. Humic acids and aqueous migration of heavy metals. *Pochvovedenie* 2006, (11), 1315-1321.


H. Ninnemann. Structural characteristics of N-modified brown coals under special consideration of the humic substances. *Metadata Internet Doc. (Ger. Diss.)* **2007**, (D0327-1).


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**Thermomechanical Analysis (TMA)**

**Thin-Layer Chromatography (TLC)**


**Transmission Electron Microscopy (TEM)**


**Transmission X-Ray Microscopy (TXM)**


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**Ultraviolet-Visible Spectroscopy (UV-Vis)**


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### Voltammetry


Water Uptake


G. Fan. Super water-absorbent resin containing humic acid or salts. CN 1,637,075 (July 13, 2005).


(5179) W. Bentlage. Straw substitute containing superabsorbent for hoofed animals. DE 20/2005/007,297 (September 1, 2005).


(5185) G. Yang, Z. Li, J. Sun, L. Cui, S. Peng, Y. Cui, and H. Li. Production of a compound multifunctional water-retention agent for use in agriculture. CN 1,580,186 (February 16, 2005).


**X-ray Diffraction**

X-ray Photoelectron Spectroscopy (XPES)


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Physiology and Physiological Effects


(5349) Q. Wang, G. Zhao, J. Zhang, F. Wang, and R. Mei. Method and specific biologics for culturing *Ziziphus jujuba* rich in active superoxide dismutase. *CN* 1,807,590 (July 26, 2006).


**Toxicology**


Commercial Applications


(5372) S. I. Barger. Method of preparing ozocerite for thermal treatment. *RU* 2,277,919 (June 20, 2006).


(5374) T. Roess, W. Spyra, G. Sieling, A. Biegel, and M. Noack. Fabrics or fibrous materials consisting of lignite fibers for use in horticulture, environmental protection, construction, etc. *WO* 2006/100,065 (September 28, 2006).


**Activated Carbon Manufacture**


**Adhesive Manufacture**


**Adobe Glaze Manufacture**


**Agriculture**


E. M. F. Kehl and J. R. de L. Vicino. Process for obtaining plant nutrients, process for obtaining expanded nutrients, mixtures, expanded nutrients, formulations, use of expanded nutrients for preparation of packaging materials, as substrate for growing seeds and seedlings, in floral arrangements, as hydroponic substrate, as selective absorber of substances from aqueous media, and other products. *BR* 2004/004,668 (June 6, 2006).

T. Roess, W. Spyra, G. Sieling, A. Biegel, and M. Noack. Fabrics or fibrous materials consisting of lignite fibers for use in horticulture, environmental protection, construction, etc. *WO* 2006/100,065 (September 28, 2006).


**Bactericide**

(5393) H. Li, B. Sun, H. Yuan, and X. Xing. Manufacture and application of bactericide for controlling disease and enhancing yield of wheat. CN 101,081,035 (December 5, 2007).

Fertilizer


(4746) Y. Nie, Y. Xu, and D. Yue. Method for treating domestic garbage landfill leachate. CN 1,669,958 (September 21, 2005).


(4763) D. Yang. Fermentation method for manufacturing composite fertilizer from sludge. CN 1,911,868 (February 14, 2007).


(4783) G. Hu, Y. Li, and Z. Sun. Method for treating waste gas containing sulfur dioxide and heavy metals by humic acid, with composite fertilizers as byproducts. CN 101,041,599 (September 26, 2007).


G. Yang, Z. Li, J. Sun, L. Cui, S. Peng, Y. Cui, and H. Li. Production of a compound multifunctional water-retention agent for use in agriculture. CN 1,580,186 (February 16, 2005).


S. Feng. Spherical fertilizer with double coating layers and double films. CN 2,771,202 (April 12, 2006).


A. Wang, K. Zhang, L. Yang, and Z. Li. Preparation of a nutrient-supplying agent, from attapulgite clay, for improving highly saline alkali soils. CN 1,699,507 (November 23, 2005).
(5403) Y. Shang. Release-controlled composite fertilizer containing multiple elements. CN 1,824,630 (August 30, 2006).


(5405) B. Zhao, Y. Li, Xi. Li, Xia. Li, and L. Wang. Double-controllable compound slow-release fertilizer and its preparation. CN 1,827,559 (September 6, 2006).


(5409) G. Zhang. Manufacture of composite fertilizer containing biological, organic and inorganic materials for tobacco. CN 1,834,068 (September 20, 2006).


(5413) W. Yu. Manufacture of liquid fertilizer containing nitrogen, phosphorus and potassium. CN 1,844,060 (October 11, 2006).

(5414) H. Zhang, Y. Ding, and H. Jin. Environmentally friendly pesticidal fertilizer for preventing and treating wilt disease and its preparation. CN 1,847,200 (October 18, 2006).

(5415) Y. Qiao and W. Qiao. Method for converting mineral resources into organic fertilizer. CN 1,847,199 (October 18, 2006).


(5421) G. Chen, S. Li, and D. Li. Ecological organic nutrient agent for lawn and its preparation method. CN 1,709,839 (December 21, 2005).


(5425) B. Lin. Pesticide-free vegetable organic fertilizer capable of preventing pest. CN 1,712,389 (December 28, 2005).


(5427) F. Liu. Method for preparing fertilizer specific for saline-alkali soil. CN 1,865,195 (November 22, 2006).

(5429) H. S. Lee. Fertilizer composition containing chungito, composition for maintaining freshness comprising the same and portable fruit or vegetable box using the same. KR 2006/082,154 (July 18, 2006).

(5430) S. Meng. Multiple-effective pesticidal biofertilizer and its preparation. CN 1,868,979 (November 29, 2006).


(5432) X. Zhang. Two-stage process for preparing methane and fertilizer from semisolid organic waste. CN 1,872,804 (December 6, 2006).

(5433) X. Li. Method for manufacturing organic compound fertilizer for nourishing soils. CN 1,872,817 (December 6, 2006).


(5440) S. Pathare. Manufacture and use of multiple activity granulated biofertilizer formulation for plant growth and pest control. IN 2005/MU00,567 (October 14, 2005).

(5441) S. S. Chaudhry. A process of producing an improved bio extract organic fertilizer in liquid, powder and granular form. IN 2005/MU00,038 (August 11, 2006).


(5455) V. V. Degtyarev and A. V. Apkaneev. Method for preparing fertilizer. **RU** 2,256,635 (July 20, 2005).


P. Jiang and Y. Pang. Manufacture of compound fertilizer from lignite or efflorescent lignite. CN 1,562,910 (January 12, 2005).


B. Shao. Preparation of natural liquid fertilizer containing wood vinegar. CN 1,562,915 (January 12, 2005).


C. Song and G. Song. Specific composite fertilizer for tobacco cultivation. CN 1,562,909 (January 12, 2005).


X. Wen and D. Liang. Preparation of granulated fertilizer containing organic substances. CN 1,583,682 (February 23, 2005).


L. Yan, X. Jia, J. Lu, W. Cao, and X. Li. Compound microbial fertilizer containing decomposing bacteria for humic acid. CN 1,587,218 (March 2, 2005).


S. Hao and Z. Zuo. Method for producing agricultural compositions containing humic acid. CN 1,593,156 (March 16, 2005).

C. Li. Method for preparing special fertilizer series from urban sludge. CN 1,594,225 (March 16, 2005).

F. Han, C. He, B. Han, and F. Ji. Manufacture of sustained-release compound fertilizer from catalyst byproduct. CN 1,569,7772 (January 26, 2005).


T. Chang. Manufacture of fertilizer from marine organisms. CN 1,569,753 (January 26, 2005).

A. Sanchez, M. Juarez, J. Sanchez-Andreu, J. Jorda, and D. Bermudez. Use of humic substances and amino acids to enhance iron availability for tomato plants from applications of the chelate FeEDDHA. J. Plant Nutr. 2005, 28(11), 1877-1886.


C. Ren, Y. Xun, and L. Zhu. Fermentation and manufacture of composite bacterial preparations and organic bacterial fertilizers for preventing and treating soilborne diseases and pests. CN 1,616,648 (May 18, 2005).


M. Zhang. Manufacture of humic acid and urea-containing compound fertilizer. CN 1,580,005 (February 16, 2005).

Z. Zhang. Manufacture of organic fertilizer containing multiple elements. CN 1,580,007 (February 16, 2005).

M. Zhang. Organic ground fertilizer containing potassium sulfate and diammonium phosphate. CN 1,580,004 (February 16, 2005).


(5493) H. Zhao and Z. Zhang. Method for preparing granules containing peat and humate as fertilizer. **CN** 101,081,701 (December 5, 2007).


(5496) C. Liu. Composite fertilizer for garlic. **CN** 101,081,763 (December 5, 2007).


(5498) Y. Du. Formula and preparation process of controlled-release fertilizer. **CN** 101,081,788 (December 5, 2007).

(5499) Y. Du. Method for preparing pelletizing agent used in combination of fertilizer. **CN** 101,081,798 (December 5, 2007).

(5500) C. Liu. Preparation of special fertilizer for flue-cured tobacco cultivation. **CN** 101,081,768 (December 5, 2007).

(5501) Y. Du. Process for preparing biological composite fertilizer. **CN** 101,081,775 (December 5, 2007).

(5502) Y. Du. New biofertilizer production process. **CN** 101,081,777 (December 5, 2007).

(5503) Y. Du. Composite fertilizer of humic acid and rare earth and its preparation process. **CN** 101,081,783 (December 5, 2007).
(5504) Y. Du. Process for production of multielement fertilizer. CN 101,081,784 (December 5, 2007).

(5505) Q. Li. Biological organic-inorganic complex fertilizer. CN 101,092,314 (December 26, 2007).


(5510) N. Xia and T. Yu. Method for producing compound fertilizer containing humic acid and iron. CN 101,012,139 (August 8, 2007).


(5516) X. Chen. Specific composite organic fertilizer for tobacco, tea, flower, fruit tree and vegetable. CN 101,020,616 (August 22, 2007).

(5517) G. Zhao. Water-resistant sustained-release peat composite fertilizer. CN 2,898,017 (May 9, 2007).


(5521) D. Marks. Agricultural fertilizer composition useful in administering in particular secondary or micronutrients to plants. GB 2,435,470 (August 29, 2007).


(5525) X. Jia, Y. Li, X. Li, C. Li, and P. Li. All-element compound fertilizer and its manufacturing method. CN 101,037,370 (September 19, 2007).


-280-


G. Yin. Method for preparing humic acid compound fertilizer. CN 101,041,600 (September 26, 2007).


X. Li. Production of selenium-rich ecological fertilizer. CN 101,054,315 (October 17, 2007).


P. Du. Crop liquid fertilizer with balanced nutrition. CN 1,887,825 (January 3, 2007).


S. Wang, Y. Wang, and X. He. Manufacture of synergistic composite fertilizer for flue-cured tobacco. CN 1,896,035 (January 17, 2007).


(5556) A. Guo and J. Yu. Sustained-release additive for compound fertilizer. CN 1,919,804 (February 28, 2007).


(5558) X. Li, Y. Ma, B. Zhang, and H. Li. Organic nitrogen fertilizer containing urea, humic acid and fermented manure of livestock and poultry. CN 1,923,765 (March 7, 2007).


(5560) C. Fang. Manufacture of urea-humate fertilizer. CN 1,927,775 (March 14, 2007).


(5562) C. Liu and J. Liu. Antiviral fertilizer additive for plants and fertilizer containing it. CN 1,935,750 (March 28, 2007).


H. Wang, W. Yin, Y. Wang, and X. Luo. Method for dwarf pot culturing Paeonia. CN 1,586,118 (March 2, 2005).


W. Guo. Method for preparing algae-humic acid microorganism fertilizer via microorganism degradation. CN 1,640,854 (July 20, 2005).

J. Yin. Special fertilizer for Capsicum frutescense. CN 1,743,296 (March 8, 2006).


Y. Yan. Fertilizer for spray applying. *CN* 1,673,201 (September 28, 2005).


X. Liu. Planting of *Physalis alkekengi* by use of vegetative propagation. *CN* 1,739,334 (March 1, 2006).


L. Yao. Preparation and application of fertilizer synergist containing humic acid and composite strain. *CN* 1,669,991 (September 21, 2005).


C. Yang. Rare earth biologic multielement compound fertilizer. *CN* 1,657,508 (August 24, 2005).

(5596) J. Ip and W. Blampied. Manufacture of low-odor fertilizer. CA 2,491,205 (March 14, 2006).

(5597) F. Zhang, Q. Yao, Y. Wang, X. Liu, and J. Zhang. Production process for blended high concentration sustained release fertilizer. CN 1,654,439 (August 17, 2005).


(5601) H. Zhang, Y. Ding, and H. Jin. Manufacture of environmentally friendly pesticide-containing fertilizer for control of nematodes and underground pest. CN 1,654,446 (August 17, 2005).


(5604) A. Ji. Manufacture of tillage-free organic fertilizers containing edible fungi leftover. CN 1,629,103 (June 22, 2005).


(5607) H. Ma. Biological foliage fertilizer. CN 1,631,850 (June 29, 2005).

(5608) W. Yang, Q. Luan, S. Lu, Y. Wang, and Y. Hu. Organic fertilizer and production thereof. CN 1,631,852 (June 29, 2005).
(5609) W. Yang, Q. Luan, S. Lu, Y. Wang, and Y. Hu. Multifunctional biological, organic and inorganic blended fertilizer and production thereof. **CN** 1,631,854 (June 29, 2005).


(5611) Q. Li. Method for preparing antimicrobial multifunctional agrochemicals. **CN** 1,784,963 (June 14, 2006).

(5612) G. Melcioiu. Complex liquid fertilizer. **RO** 120,403 (January 30, 2006).


(5617) X. Zhao, S. Dong, F. Wang, W. Sun, and Z. Jie. Fertilizer with high fertility and long effect for breeding aquatic products. **CN** 1,686,963 (October 26, 2005).


(5619) X. Me and P. Zhao. Agent for improving crop root activity. **CN** 1,690,022 (November 2, 2005).

D. Qiu, X. Liu, X. Zhou, and Y. Yu. Fertilizer containing humate salt and activator protein. **CN 1,800,110** (July 12, 2006).

S. Chen, D. Zhao, and H. Hu. Granulating method for organic-inorganic composite fertilizer by cold-dissolving at normal temperature and pressure and spray-drying. **CN 1,800,120** (July 12, 2006).

D. Li, X. Xu, H. Wang, and Y. Hu. Fertilizer for promoting root development. **CN 1,800,114** (July 12, 2006).


Y. Zhu. Organic compound fertilizer containing ammonium humate in control of insects and diseases. **CN 1,803,737** (July 19, 2006).

Q. Wang, G. Zhao, L. Jiang, L. Ma, and R. Mei. Method and specific biologics for culturing cucumber rich in active superoxide dismutase. **CN 1,807,589** (July 26, 2006).


Y. Chen. Combined pesticide and fertilizer for control of rice stripe virus and stimulating recovery and tillering of rice. **CN 1,806,549** (July 26, 2006).


G. Luo. Medium for cultivation of flowers. **CN 1,810,738** (August 2, 2006).

Z. Ma. Liquid humic acid fertilizer containing multiple nutritive elements and the preparation method. CN 1,693,292 (November 9, 2005).


S. Li, G. Liu, and H. Pu. Controlled release fertilizer for strengthening root and inhibiting growth. CN 1,699,302 (November 23, 2005).


G. Luo. Plant liquid fertilizer containing macromolecules as solidifying agent. CN 1,778,774 (May 31, 2006).

L. P. Stepanova and M. A. Dogadina. Method for increasing the productivity of flower plants, such as *Chrysanthemum*. RU 2,277,317 (June 10, 2006).

H. Deng, K. Zhang, and J. Zhen. Highly effective multielement compound foliage fertilizer and production method. CN 1,669,996 (September 21, 2005).

J. Shao. Manufacture of multifunctional coating agent for fertilizer. CN 1,785,937 (June 14, 2006).

J. Shao. Manufacture of composite fertilizer containing trace element chelate. CN 1,785,927 (June 14, 2006).

X. Jie, H. Hu, X. Guo, M. Li, and Y. Zeng. Specific foliar fertilizer for leguminous forage. CN 1,785,929 (June 14, 2006).


S. Li. Process for manufacturing granular composite fertilizer containing humic acid. CN 1,785,935 (June 14, 2006).

J. Shao. Drying method for producing organic fertilizer from colloidal industrial waste. CN 1,785,921 (June 14, 2006).


(5674) B. Zhang. High-nutrition organic-inorganic composite fertilizer. CN 1,948,235 (April 18, 2007).

(5675) S. Zheng and X. Lu. Readily and slowly available fertilizer for cotton. CN 1,948,237 (April 18, 2007).


(5677) X. Fan. A rapid method for cultivating potted plant with root of viewing value. CN 1,948,030 (April 18, 2007).


(5681) X. Zhou. Special compound fertilizer and trace element fertilizer for Lycium barbarum and its fertilization method. CN 1,962,566 (May 16, 2007).


F. Cao, S. Mou, and M. Li. Palygorskite material-based fertilizer for flowering fruit ornamental plants. CN 1,978,405 (June 13, 2007).

F. Cao, S. Mou, and M. Li. Palygorskite material-based fertilizer for ornamental plants. CN 1,978,404 (June 13, 2007).

F. Cao, S. Mou, and M. Li. Palygorskite material-based fertilizer for flower bulbs and flower succulents. CN 1,978,403 (June 13, 2007).

F. Cao, S. Mou, and M. Li. Palygorskite material-based fertilizer for leaf, stem, and flower. CN 1,978,402 (June 13, 2007).

F. Cao, S. Mou, and M. Li. Palygorskite material-based fertilizer for medical plants. CN 1,978,401 (June 13, 2007).


X. Chen. Method for selective breeding and cultivation of high quality sorghum variety. CN 100,998,308 (July 18, 2007).


**Fungicide**


**Herbicide**


**Insecticide**

(5627) Y. Zhu. Organic compound fertilizer containing ammonium humate in control of insects and diseases. CN 1,803,737 (July 19, 2006).

(5712) P. A. Dattatray and P. B. Abhay. Photostable *Bacillus thuringiensis kurstaki* bioinsecticide composition. IN 2000/MU00,096 (May 5, 2006).


**Pesticide**

(5425) B. Lin. Pesticide-free vegetable organic fertilizer capable of preventing pest. CN 1,712,389 (December 28, 2005).

(5430) S. Meng. Multiple-effective pesticidal biofertilizer and its preparation. CN 1,868,979 (November 29, 2006).

(5440) S. Pathare. Manufacture and use of multiple activity granulated biofertilizer formulation for plant growth and pest control. IN 2005/MU00,567 (October 14, 2005).


(5483) C. Ren, Y. Xun, and L. Zhu. Fermentation and manufacture of composite bacterial preparations and organic bacterial fertilizers for preventing and treating soilborne diseases and pests. CN 1,616,648 (May 18, 2005).

(5601) H. Zhang, Y. Ding, and H. Jin. Manufacture of environmentally friendly pesticide-containing fertilizer for control of nematodes and underground pest. CN 1,654,446 (August 17, 2005).

Y. Chen. Combined pesticide and fertilizer for control of rice stripe virus and stimulating recovery and tillering of rice. **CN** 1,806,549 (July 26, 2006).

Anon. The application of humates and modified humates as adjuvants in pesticides. **DE** 19,713,129 (October 2, 1997).


J. Min, W. Zhou, and L. Wu. Environment-friendly pesticide containing allelopathic compounds. **CN** 1,729,789 (February 8, 2006).

S. Hao and Z. Zuo. Preparation of pesticide from crop straw for preventing and treating plant diseases. **CN** 101,040,623 (September 26, 2007).

B. Sun, H. Li, H. Yuan, and X. Xing. Pesticide for disease control and yield increase of wheat, and its preparation and application methods. **CN** 101,081,036 (December 5, 2007).

**Plant Growth Stimulant**


Q. Wang, G. Zhao, J. Zhang, F. Wang, and R. Mei. Method and specific biologics for culturing *Ziziphus jujuba* rich in active superoxide dismutase. *CN 1,807,590* (July 26, 2006).

E. M. F. Kehl and J. R. de L. Vicino. Process for obtaining plant nutrients, process for obtaining expanded nutrients, mixtures, expanded nutrients, formulations, use of expanded nutrients for preparation of packaging materials, as substrate for growing seeds and seedlings, in floral arrangements, as hydroponic substrate, as selective absorber of substances from aqueous media, and other products. *BR 2004/004,668* (June 6, 2006).


G. Qian and Q. Yang. Manufacture of plant growth regulator for improving drought and waterlog tolerance and increasing yield. CN 1,802,924 (July 19, 2006).

Y. Huang. Use of sodium humate for increasing temperature of rice field in cold region. CN 1,640,268 (July 20, 2005).

I. N. Titov. Method of manufacturing a biological stimulator of growth and development of plants from humus-containing substances. RU 2,253,641 (June 10, 2005).

T. Nakajima. Substances used in agriculture and horticulture for promoting plant growth and crop quality. CN 1,915,916 (February 21, 2007).

Q. Shang and Z. Zhang. Plant growth regulator containing gibberellin and chitosan for promoting growth and enhancing disease resistance of vegetable. CN 1,887,092 (January 3, 2007).


S. Hao and Z. Zuo. Method for preparing compound plant growth regulator containing humic acid from crop straws. CN 101,040,622 (September 26, 2007).

B. N. Ogarkov and V. I. Butakov. Preparation for wheat plant growth stimulation and protection from diseases. RU 2,305,405 (September 10, 2007).


J. Ma, Q. Zhang, and L. Ye. Manufacture of plant growth regulator containing bamboo vinegar. *CN* 1,600,754 (March 30, 2005).


M. Suchomelova. Growth activator for plants and process for its manufacture. CZ **296,785** (June 14, 2006).

C. Jeng and S. R. Munagala. A plant growth regulator comprising plant growth promoting rhizobacteria (PGPR) and method for culturing agronomic crops by using the preparation. CN **1,699,298** (November 23, 2005).

**Plant Protectant**

Z. Tian. Humic acid-copper bactericide for control of fruit trunk disease. CN **1,593,154** (March 16, 2005).

H. Li, B. Sun, H. Yuan, and X. Xing. Manufacture and application of bactericide for controlling disease and enhancing yield of wheat. CN **101,081,035** (December 5, 2007).


S. Hao and Z. Zuo. Method for producing agricultural compositions containing humic acid. CN **1,593,156** (March 16, 2005).
C. Ren, Y. Xun, and L. Zhu. Fermentation and manufacture of composite bacterial preparations and organic bacterial fertilizers for preventing and treating soilborne diseases and pests. CN 1,616,648 (May 18, 2005).

Q. Li. Method for preparing antimicrobial multifunctional agrochemicals. CN 1,784,963 (June 14, 2006).

Y. Zhu. Organic compound fertilizer containing ammonium humate in control of insects and diseases. CN 1,803,737 (July 19, 2006).

Y. Chen. Combined pesticide and fertilizer for control of rice stripe virus and stimulating recovery and tillering of rice. CN 1,806,549 (July 26, 2006).

A. A. Ivanov. Preparation Extragan for stimulating plant growth and protection from diseases. RU 2,302,114 (July 10, 2007).

Q. Shang and Z. Zhang. Plant growth regulator containing gibberellin and chitosan for promoting growth and enhancing disease resistance of vegetable. CN 1,887,092 (January 3, 2007).


B. N. Ogarkov and V. I. Butakov. Preparation for wheat plant growth stimulation and protection from diseases. RU 2,305,405 (September 10, 2007).

J. Ma, Q. Zhang, and L. Ye. Manufacture of plant growth regulator containing bamboo vinegar. CN 1,600,754 (March 30, 2005).

L. P. Stepanova and M. A. Dogadina. Method for increasing disease resistance of flower crops, such as Gladiolus. RU 2,277,772 (June 20, 2006).

J. Cui, Y. Ma, C. Shen, J. Luo, C. Wang, and S. Li. Integrated control of diseases, insects and mites for transgenic Bt cotton. CN 1,820,568 (August 23, 2006).


Y. Sun, L. Sun, and Y. Zhan. Agent for treating and preventing replant disease of pollution-free plant. CN 1,644,055 (July 27, 2005).


Y. Huang and Z. Kuang. Method for completely curing yellow leaf blotch of banana tree. CN 1,600,059 (March 30, 2005).


**Planting Mat**


Seed Coating/Treatment

(5385) E. M. F. Kehl and J. R. de L. Vicino. Process for obtaining plant nutrients, process for obtaining expanded nutrients, mixtures, expanded nutrients, formulations, use of expanded nutrients for preparation of packaging materials, as substrate for growing seeds and seedlings, in floral arrangements, as hydroponic substrate, as selective absorber of substances from aqueous media, and other products. BR 2004/004,668 (June 6, 2006).

(5393) H. Li, B. Sun, H. Yuan, and X. Xing. Manufacture and application of bactericide for controlling disease and enhancing yield of wheat. CN 101,081,035 (December 5, 2007).


D. Qui, Y. Yu, Y. Liu, and X. Liu. Biological seed dressing agent containing active protein. **CN** 1,799,361 (July 12, 2006).


Y. M. Luzhkov, G. N. Vorozhtsov, A. N. Kalinichenko, N. M. Plotnikova, and V. V. Reinfart. Property-controllable capsule for sprouting and growing seeds, capsulated planting stock comprising a seed or a shaped sprout and method for the production thereof. **WO** 2005/120,208 (December 22, 2005).

A. Wang, K. Zhang, and R. Liu. Seed coating agent suitable for aerial seeding especially in desert. **CN** 1,739,349 (March 1, 2006).

(5775) A. L. Lukin, V. V. Kotov, E. A. Lukina, V. T. Rymar, N. V. Gvozdev, and S. V. Slavgorodskii. Presowing seed treatment method. RU 2,270,547 (February 27, 2006).


(5784) Y. Wang. Compound formulation for treating cotton diseases during seedling stage. CN 1,853,482 (November 1, 2006).


(5786) Y. Ding and Q. Wu. Preparation of seed coating agent containing nanoparticles with low toxicity and high efficiency. CN 1,701,665 (November 30, 2005).

Soil Amendment


A. Sanchez, M. Juarez, J. Sanchez-Andreu, J. Jorda, and D. Bermudez. Use of humic substances and amino acids to enhance iron availability for tomato plants from applications of the chelate FeEDDHA. *J. Plant Nutr*. 2005, 28(11), 1877-1886.


X. Me and P. Zhao. Agent for improving crop root activity. *CN 1,690,022* (November 2, 2005).


Y. Huang. Use of sodium humate for increasing temperature of rice field in cold region. *CN 1,640,268* (July 20, 2005).


-310-


T. Wang. Preparation of an agent for soil improvement. CN 1,928,000 (March 14, 2007).


(5821) S. Wang. Manufacture of composite agent for crop cultivation in dry land. **CN** 1,580,010 (February 16, 2005).


(5829) S. D. Singh. AKS Biocrop formulation of humic acid. **IN** 2002/MU00,055 (November 11, 2005).


(5831) A. Wang, K. Zhang, and X. Yang. Production of a material for fixing soil, for plant revegetation. **CN** 1,854,247 (November 1, 2006).


(5834) X. Zhang and C. Ma. Method for manufacturing full-nutrient saline-soil amendment for *Oryza sativa* fields. **CN** 1,854,244 (November 1, 2006).

(5835) Y. Wang. Production of an amendment agent for saline soils, from gypsum phosphate, crop straws, and crop nutrients. **CN** 1,854,245 (November 1, 2006).

(5836) T.-S. Wen. Soil additives. **TW** 228,497 (March 1, 2005).

(5837) Y. Zhao, X. Wang, B. Deng, C. Wang, L. Wang, X. Liu, Y. Zhao, and J. Hou. A method for the preparation of a biological activating agent for soils. **CN** 1,831,085 (September 13, 2006).


(5840) A. Wang, A. Li, Q. Wang, and R. Liu. A method for the production of multifunctional salt-resistant water-retaining agent, from attapulgite, for the slow release of organic substances. **CN** 1,699,508 (November 23, 2005).

**Air Purification**

(5841) Z. Wen. Application of humate biochemical fluid in indoor air purification. **CN** 1,562,448 (January 12, 2005).

(5842) X. Cheng. Refrigerator deodorant containing natural organic compound. **CN** 1,775,295 (May 24, 2006).

**Algicide**

Alumina Processing


Ammonium Phosphate Processing


Animal Feed Additive


(5844) L. Wangwu. Nutritional feed for ruminants. CN 1,669,463 (September 21, 2005).

(5845) G. Liu. Manufacture and application of sodium humate-containing preparation for promoting growth of livestock. CN 1,672,551 (September 28, 2005).

(5846) D. Zhao and B. Tang. Active biological feed additive. CN 1,676,019 (October 5, 2005).


(5853) T. Jiang. Complete pellet feed for young meat chicken. **CN** 1,943,398 (April 11, 2007).


(5855) W. Zhang, Z. Qian, and F. Yi. Refined preparation of Chinese medicinal composition used as feed additive for aquatic animals for preventing diseases and promoting growth. **CN** 1,934,988 (March 28, 2007).

(5856) Y. Wang. Application of feed additive containing montmorillonite. **CN** 1,718,078 (January 11, 2006).


(5863) V. A. Isaev, V. Yu. Eydel'man, G. M. Erastov, and V. A. Terent'ev. Feed additive for poultry and farm animals and method for increasing their performance and resistance. **RU** 2,312,518 (December 20, 2007).


(5867) Y. Wei. Rare earth-containing nutritional feed additive and its production method. CN 1,586,270 (March 2, 2005).


(5878) Y. Ren and D. An. Highly-concentrated feed for pig with complete nutrient. **CN** 1,698,459 (November 23, 2005).

**Antiscaling/Corrosion Inhibition**

(5879) Z. Shen. Acidic descaling agent for cooling water system. **CN** 1,754,835 (April 5, 2006).


(5882) X. Yu and X. Li. Method for producing controlled-release scale inhibitor and its application. **CN** 1,986,456 (June 27, 2007).


(5884) Z. Shen. Manufacture of scale and corrosion inhibitor. **CN** 1,715,215 (January 4, 2006).

(5885) Z. Shen. Manufacture of acidic scale remover. **CN** 1,715,214 (January 4, 2006).

(5886) Q. Gong, Y. Zhao, J. Shi, and M. Sheng. Manufacture of composite antiscale-corrosion inhibitor for treating recirculated cooling water. **CN** 1,772,656 (May 17, 2006).

(5887) Z. Shen. Cleaning agent for industrial cooling circulating water system. **CN** 1,754,839 (April 5, 2006).

(5888) Z. Shen. Scale inhibitor for industrial cooling water system. **CN** 1,754,840 (April 5, 2006).

(5889) Z. Shen. Cleaning agent for water system of central air conditioning. **CN** 1,754,841 (April 5, 2006).

(5890) Z. Shen. Acidic descaling agent for circulating water system of central air conditioning. **CN** 1,754,844 (April 5, 2006).
(5891) D. Rong. Composite scale and corrosion inhibitor as water treating agent. CN 1,887,749 (January 3, 2007).


(5893) Z. Shen. Scale/corrosion inhibitor with antioxidation for boiler. CN 1,854,090 (November 1, 2006).

(5894) Z. Shen. Method for scale/corrosion inhibition for boiler. CN 1,854,092 (November 1, 2006).


(5896) Z. Shen. Method for manufacturing high-performance scale-inhibitor dispersant with high scale-inhibiting rate. CN 1,837,099 (September 27, 2006).

(5897) Z. Shen. Manufacture of scale inhibitor dispersant containing sulfonic acid copolymer for industrial process water. CN 1,837,103 (September 27, 2006).


(6167) C. Zhai. Antiscale and detergent for treating industrial circulating cooling water. CN 1,666,963 (September 14, 2005).

Aquaculture


(5617) X. Zhao, S. Dong, F. Wang, W. Sun, and Z. Jie. Fertilizer with high fertility and long effect for breeding aquatic products. *CN* 1,686,963 (October 26, 2005).


(5855) W. Zhang, Z. Qian, and F. Yi. Refined preparation of Chinese medicinal composition used as feed additive for aquatic animals for preventing diseases and promoting growth. *CN* 1,934,988 (March 28, 2007).


(5903) F. Cao, S. Mou, and M. Li. Nutrient solution with solid matrix for soilless culture of plant. *CN* 1,977,591 (June 13, 2007).

**Ash/Water Slurries**


**Bactericide**


**Battery Manufacture**


(4740) N. Fang. Process for production of coal humic acid for lead storage battery. CN 1,663,987 (September 7, 2005).


(5908) Y. Chen and J. Chen. High-energy maintenance-free hermetically sealed lead-acid storage battery for submarine. CN 1,591,957 (March 9, 2005).

(5909) Y. Chen. 6-TK(M)-360 type high-energy dry-charged sealed maintenance-free lead-acid storage battery for tank. CN 1,688,055 (October 26, 2005).

(5910) Y. Chen. 12-TK(M)-100 type high-energy dry-charged sealed maintenance-free lead-acid storage battery for armored car. CN 1,688,056 (October 26, 2005).

(5911) Y. Chen. 12-HK(M)-30 type high-energy dry-charged sealed maintenance-free lead-acid battery. CN 1,688,057 (October 26, 2005).

(5912) Y. Chen. 12-TK(M)-220 type high-energy dry-charged sealed maintenance-free lead-acid storage battery for tank. CN 1,688,058 (October 26, 2005).

(5913) Y. Chen. 12-TK(M)-160 type high-energy dry-charged sealed maintenance-free lead-acid storage battery for armored car. CN 1,688,059 (October 26, 2005).

(5914) Y. Chen. 12-HK(M)-28 type high-energy dry-charged sealed maintenance-free lead-acid storage battery. CN 1,688,060 (October 26, 2005).

(5915) Y. Chen. 6-HK(M)-55 type high-energy dry-charged sealed maintenance-free lead-acid storage battery. CN 1,688,061 (October 26, 2005).

(5916) Y. Chen. High-energy maintenance-free sealed lead-acid electric battery for submarines. CN 1,652,382 (August 10, 2005).

(5917) Y. Chen. High-energy maintenance-free sealed lead-acid storage battery for submarines. CN 1,652,383 (August 10, 2005).
(5918) Y. Chen. High-energy maintenance-free sealed lead-acid storage battery for submarines. CN 1,652,384 (August 10, 2005).

(5919) Y. Chen. High-energy maintenance-free sealed lead-acid electric battery for submarines. CN 1,652,385 (August 10, 2005).

(5920) Y. Chen. High-energy maintenance-free sealed lead-acid electric battery for submarines. CN 1,652,386 (August 10, 2005).

(5921) Y. Chen. High-energy maintenance-free sealed lead-acid electric battery for miner lamp. CN 1,652,388 (August 10, 2005).

(5922) Y. Chen. Cathode plate structure of high-energy sealed lead-acid storage battery for submarine. CN 1,677,727 (October 5, 2005).


(5924) M. Zhou and X. Liu. Process for fabricating colloid electrode of lead-acid storage battery. CN 1,758,464 (April 12, 2006).


(5927) J. Li, G. Cao, and L. Wang. Lead plaster as negative pole of valve-controlled sealed lead-acid storage battery for starting automobile. CN 1,747,205 (March 15, 2006).


(5930) Y. Chen. High-energy maintenance-free secondary lead-acid battery for light on miner's helmet. CN 1,933,231 (March 21, 2007).

(5931) Y. Chen. High-energy hermetically-sealed lead-acid electric battery used in naval ships. CN 1,933,220 (March 21, 2007).

(5932) Y. Chen. Anode active mass composite for high-energy sealed maintenance-free secondary lead-acid battery of rail engine. CN 1,933,217 (March 21, 2007).
(5933) C. Zhao and C. Wu. Lead paste for cathode of lead-acid storage battery of motorcycle, and its preparation method. CN 101,071,855 (November 14, 2007).

(5934) G. Feng. Electrode plates and electrolyte of lead storage battery for electric bicycle. CN 1,967,912 (May 23, 2007).

(5935) Y. Chen. High-energy totally-sealed secondary lead-acid battery for starting helicopters. CN 1,960,041 (May 9, 2007).


(5937) Y. Chen. High-energy hermetically-sealed secondary lead-acid battery for starting battle planes and bombing planes. CN 1,949,566 (April 18, 2007).

(5938) Y. Chen. High-energy hermetically-sealed secondary lead-acid battery for starting tank. CN 1,949,565 (April 18, 2007).

(5939) Y. Chen. High-energy sealed lead-acid battery used in electric vehicle. CN 101,060,174 (October 24, 2007).


(5942) J. Li, G. Lai, H. Huang, X. Xia, J. Xue, and D. Li. Preparation of high density ultrafine composite lithium iron phosphate as cathode material for lithium ion batteries. CN 1,907,844 (February 7, 2007).

(5943) Y. Song, J. Luo, and X. Huang. Gel storage battery for electromobile. CN 1,905,264 (January 31, 2007).


**Beverage Additive**

(5945) N. Liu and J. Wang. Health beverage containing humic acid and the application of humic acid in beverage. CN 1,568,827 (January 26, 2005).

**Binder**

(5950) R. Chen, J. Mou, P. He, and F. Gan. Chrome-free MgO-ZrO₂-SiO₂ based refractory material for RH vacuum furnace liner. CN 1,715,246 (January 4, 2006).
Coal Briquettes


(5947) G. Chen. Method for preparing multifunctional additive for clean gas-production briquette. CN 1,710,034 (December 21, 2005).


(5949) I. F. Savchenko and A. P. Sorokin. Production of fuel briquets from low-calorific high-moisture coals. RU 2,252,948 (May 27, 2005).

(5950) R. Chen, J. Mou, P. He, and F. Gan. Chrome-free MgO-ZrO₂-SiO₂ based refractory material for RH vacuum furnace liner. CN 1,715,246 (January 4, 2006).


(5955) D. Rong. Activated coal-based binder for manufacture of molded coal-based fuel briquets. CN 1,923,985 (March 7, 2007).


Iron Ore Pellets

(5958) Y. Zhang, T. Chen, and T. Liu. Manufacture of adhesive for iron ore pellets. CN 1,814,825 (August 9, 2006).
(5959) Y. Zhang, T. Chen, and T. Liu. Method for preparing iron-ore pellets containing Boltonite and adhesive with high thermal stability, high strength and good reducing property. CN 1,807,662 (July 26, 2006).

(5960) F. Xian, D. Yang, and J. Sun. Preparation, direct reduction and electric furnace smelting process of cold bound carbon-containing pellet from vanadium-titanium magnetite. CN 1,804,059 (July 19, 2006).

(5961) Q. Zhang and Y. Li. Manufacture of iron powder pellets from flue dust for steelmaking. CN 1,733,947 (February 15, 2006).


Wood Pellets


Biocide


Bone China Manufacture


Brick Manufacture


(5967) X. Zhong. Manufacture of polished bricks by low-temperature sintering. CN 1,907,908 (February 7, 2007).


Brick Glaze Additive

Calcium Carbonate Processing


Capacitor Manufacture


Catalyst Component


**Cement/Concrete Manufacture**


(5987) Q. Li and H. Li. A method for the production of an agent in the grinding of cement. **CN 1,566,017** (January 19, 2005).


**Coloring Agent**


**Ceramics Manufacture**


(5990) S. Li. Manufacture of infrared ceramic electrothermal substrate. *CN* 1,731,897 (February 8, 2006).

(5991) Y. Chen and M. Li. Heat resistant ceramic prepared by moderate temperature sintering, and its preparation method. *CN* 1,730,430 (February 8, 2006).


(5999) E. Saleh. Production of clay-based ceramics and sanitary ware from silica, silicate minerals and clay mixtures. *US* 2007/0,149,383 (June 28, 2007).

**Clay Processing**


Clay/Water Slurries


Coal Processing


(6003) P. Zhang and J. Li. Manufacture of coal-fuel oil emulsion for industrial boiler. CN 1,958,754 (May 9, 2007).


(6005) S. Ge. Manufacture and application of environmentally-friendly coal for gas production. CN 1,931,973 (March 21, 2007).


Coal/Water Slurries


Coke Manufacture


(6022) S. Cheng. Preparation of adhesive for coke powder molding. CN 1,789,392 (June 21, 2006).

(6023) W. Ning, X. Li, and L. Wu. Method for preparing formed coke from weakly caking coal. CN 1,850,942 (October 25, 2006).

Construction/Building Materials


(6024) B. Wu, Y. Zhou, and J. Song. A method for the production of building materials, based on quartz sand. CN 1,709,818 (December 21, 2005).
(6025) G. Deng. A method for manufacturing a curing agent for construction materials. CN 1,884,182 (December 27, 2006).

**Copy Toner**


**Cosmetics Additive**


(6035) S. Liao, D. Liang, and T. Liang. Stabilized pharmaceutical and cosmetic composition of catechins or derivatives. CA 2,518,844 (January 27, 2007).
(6036) S. Liao, D. Liang, and J. Liang. New formulations of catechin or its derivatives for medical and cosmetic use. **CN 1,951,383** (April 25, 2007).

**Culture Medium Additive**


**Deodorizing Agent**


**Gases**


(6041) M. Prunty and D. Seaby. Granular deodorant for refuse and compost composition comprising humic substance, such as peat, on structural carrier. **GB 2,439,047** (December 19, 2007).

**Desulfurization**


**Diaper Manufacture**

**Drilling Mud Additive**


(6049) C. Yang, B. Yang, X. Ma, Z. Lin, J. Zhang, H. Wen, and E. Chen. Oil-soluble temporary plugging drilling fluid for protecting low-permeable sand petroleum-gas reservoirs. *CN* 1,664,049 (September 7, 2005).


(6052) Z. Yin, X. Wang, F. Xu, X. Geng, Y. Wang, C. Lin, and X. Li. Slurry for horizontal directional drilling of drift sand layer. *CN* 1,563,261 (January 12, 2005).


(6055) G. Tan. Preparation of high-temperature-resistant viscosity reducing agent for drilling fluid. *CN* 1,807,542 (July 26, 2006).


RU 2,289,603 (December 20, 2006).


CN 1,982,379 (June 20, 2007).

A. O. Vasil’chenko, O. V. Kusturova, and M. A. Mislyuk. Synergetic compositions of chemical reagents as a basis of systems of drilling fluids. 

M. G. Tutuianu, I. Ana, and M. Orosz. Polymer-based drilling fluid. 
RO 121,217 (January 30, 2007).

CN 101,081,975 (December 5, 2007).

CN 1,903,973 (January 31, 2007).

Dye Applications

P. Savarino, E. Montoneri, M. Biasizzo, P. Quagliotto, G. Viscardi, and V. Boffa. Upgrading biomass wastes in chemical technology. Humic acid-like matter isolated from compost as chemical auxiliary for textile dyeing. 

G. Yang, L. Yang, X. Wang, and Y. Li. Experimental study of dyeing ammonium phosphate with humic acid. 

D. J. Hughes. Colorant for foliage of humic and/or fulvic acid and dye. 

JP 2005/263,820 (September 29, 2005).

US 1005/0,163,936 (July 28, 2005).

CN 1,597,639 (March 23, 2005).


Electrode Fabrication

(6072) Y. Fu. Lead-acid accumulator jar containing lead oxide and lead nanoparticles in magnetic plate electrodes. CN 1,700,497 (November 23, 2005).


Fabrics Manufacture

(5386) T. Roess, W. Spyra, G. Sieling, A. Biegel, and M. Noack. Fabrics or fibrous materials consisting of lignite fibers for use in horticulture, environmental protection, construction, etc. WO 2006/100,065 (September 28, 2006).

Firebrick Manufacture

(6078) T. Teraushi. Effects of humic substances in ball clays on the dispersion and the shaping properties of firebrick bodies. Seramikkusu 2007, 42(8), 582-585.
**Food Products Additive**


(6080) X. Qi. Slimming ice cream preparation. **CN** 101,069,556 (November 14, 2007).


**Fungicide**


**Gypsum Manufacture**


**Hair Growth Stimulation**


**Heat Transfer Medium**


**HPLC Substrate**


**Ink Manufacture**

**Ion Exchange Manufacture**


**Iron Alloy Manufacture**


**Iron Ore Processing**

(5381) Y. Wang, J. Zhang, and S. Li. Method for preparing pellet adhesive from starch and humate. *CN* 1,818,097 (August 16, 2006).


(6090) Y. Li. Refractory cast material for air inlet pipe of blast furnace, and its preparation method. *CN* 1,730,441 (February 8, 2006).


**Lip Balm**


**Microbicide**


**Oil Absorption**

**Oil Production/Processing**


**Ointment Manufacture**


**Oral Hygiene Products**


**Oxygen Scavenging**


**Paint Manufacture**

(6102) G. Gao, G. Yao, H. Sun, and P. Ren. II type Zn-Cr composite coating for antisepsis. *CN* 1,962,945 (May 16, 2007).

**Polymer Manufacture**

**Porcelain Manufacture**


(6106) F. Li, H. Yang, and K. Dong. Preparation of decorative porcelain with colorful glaze. *CN* 1,583,658 (February 23, 2005).


**Radiation Protection**


**Semiconductor Manufacture**


**Skin Care**


**Sludge Stabilization**

Soap Manufacture


Soil Remediation


(4870) X. Xue, Y. Li, F. Zha, and P. Duan. Method for preparing separating agent of oil sand and asphaltenes with natural humic acid. CN 1,884,345 (December 27, 2006).


(6114) P. Li, D. Su, J. Ju, H. Zhang, and H. Xu. Immobilization of *Bacillus* on modified peat solid and its use for bioremediation. *CN* **1,982,446** (June 20, 2007).


(6138) J. Yuan. Preparation of soil-improvement agent for treating soil pollution and recovering soil activity. **CN** 1,830,587 (September 13, 2006).

**Surfactant Manufacture**


**Textile Manufacture**


(6140) I. Lasenko. Textile articles for treating fungal and bacterial infections. **LV** 13,314 (October 20, 2005).


Printing


Tile Manufacture


Tin Ore Processing

Veterinary Medicine


(5855) W. Zhang, Z. Qian, and F. Yi. Refined preparation of Chinese medicinal composition used as feed additive for aquatic animals for preventing diseases and promoting growth. *CN* 1,934,988 (March 28, 2007).


Waste Gas Treatment


Wastewater Treatment


Z. Shen. Composition of boiler water treating agent. **CN 1,854,087** (November 1, 2006).


D. Xi, J. Li, J. Chen, and L. Zhuo. Method for treating wastewater and mixture of wastewater and sludge. **CN** 1,792,824 (June 28, 2006).

C. Zhai. Antiscale and detergent for treating industrial circulating cooling water. **CN** 1,666,963 (September 14, 2005).


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Water Purification

(4743) A. M. Rizzuti, D. D. Nguyen, and A. D. Cohen. Using gas chromatography with solid-phase microextraction to evaluate peats for their capacities to extract methyl tertiary butyl ether from contaminated water. In Book of Abstracts, 231st ACS National Meeting; Atlanta, Georgia: American Chemical Society, 2006; CHED-867.


(6187) Z. Shen. Method for cleaning of circulation water system. CN 1,754,989 (April 5, 2006).

**Water Sealant**

(6188) X. Cui and Y. Zhao. Production of a permeation-resistant and water-saving agent for the bed surface of reservoirs. CN 101,029,234 (September 5, 2007).
Therapeutic Applications


N. Liu and J. Wang. Health beverage containing humic acid and the application of humic acid in beverage. CN 1,568,827 (January 26, 2005).

S. Liao, D. Liang, and T. Liang. Stabilized pharmaceutical and cosmetic composition of catechins or derivatives. CA 2,518,844 (January 27, 2007).

S. Liao, D. Liang, and J. Liang. New formulations of catechin or its derivatives for medical and cosmetic use. CN 1,951,383 (April 25, 2007).


**Anaphylactic Shock**


**Anti-Bacterial Agent**


**Anti-Cancer Agent**


Anti-Infective Agent

(6140) I. Lasenko. Textile articles for treating fungal and bacterial infections. LV 13,314 (October 20, 2005).

Anti-Inflammatory Properties


**Anti-Microbial Properties**


**Anti-Pyretic Agent**


**Anti-Viral Efficacy**


(5945) N. Liu and J. Wang. Health beverage containing humic acid and the application of humic acid in beverage. *CN* 1,568,827 (January 26, 2005).

**AIDS**


**Cowpox Virus**


**Herpes Viruses**


**Vaccinia Virus**


**Bleeding Disorders**

**Drug Delivery**


**Drug Synergy**


**Folk Medicine**


**Gout**

Heart Disease


Immunostimulation


(5945) N. Liu and J. Wang. Health beverage containing humic acid and the application of humic acid in beverage. *CN* 1,568,827 (January 26, 2005).


Irritable Bowel Syndrome


Osteoporosis

**Rheumatoid Disease**

**Mud Baths**


**Therapeutic Textile Manufacture**


**Wound Healing**