



NEWSLETTER

INTERNATIONAL HUMIC SUBSTANCES SOCIETY

Number 24

Spring, 2000

Ladies and Gentlemen,
Friends of the Humic Matter,

at the beginning of the new year – with that magic number – it is my pleasure to take the opportunity to wish you all success and happiness in your work and in your private life.

The year 2000 finds our society on a solid basis for the future: IHSS has new bylaws, biannual conferences and other meetings allow a direct exchange of ideas and results, a variety of fine publications guarantee a timely presentation of the state of the art and there is a growing network of national chapters.

Based on the increasing number of IHSS-representatives in all parts of the world, our society has the chance to emphasize the global importance of HS as well as to learn about their reactions under special circumstances. By this, we will be able to verify and to compare scientific results and to contribute significantly to the knowledge about HS. In addition, growing interest in the technical use and medical relevance of HS lead the way to promising applications.

Recently, the new board was elected and its members are eager to serve the society. Nevertheless, we will still need all the support we can get from former board members and all of you. Like my predecessors I firmly believe in the powerful combination of scientific rigor and personal collegiality that has always been our society's strong point.

I also want to thank all those who worked for our Society in such a fine way in the past. Especially our Past President, Jim Alberts, gave many impulses and contributed significantly to the well functioning of our Society.

Let me express my appreciation for all your interest in the Society and its activities. I wish you all the enjoyment and inspiration which is the basis for good research and I am looking forward to hearing and reading from the results of your work,

Hoping to see you soon in Toulouse,

F. H. Frimmel

IHSS 10
Toulouse, France
24-28 July 2000



**Entering the Third Millennium
with a common approach to
Humic Substances and Organic Matter
in Water, Soil and Sediments**

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International Humic Substances Society on the World Wide Web

Visit our home page at:

<http://www.ihss.gatech.edu>

Prof. E. M. Perdue coordinates the development of the IHSS WEB page. Progresses toward this goal may be followed at the above WEB site which resides on a server located at the Georgia Institute of Technology, Atlanta, USA.

Suggestions and comments regarding the content and organization of the WEB pages are actively requested from all IHSS members.

E-mail Dr. E. M. Perdue at michael.perdue@eas.gatech.edu for more information.

LIST OF NATIONAL CHAPTERS COORDINATORS

Dear colleagues,

at the last Meeting in Adelaide, the Board of Directors of the IHSS agreed: a) to reinforce contacts with national coordinators in order to improve the membership structure; b) to reduce the number of very small chapters; and c) to hasten the process of updating and completing the general membership list. After a thorough and accurate discussion concerning increased numbers of national coordinators and needs of the continuous updating process, it was decided to merge all chapters **with less than 5 members** into a Rest of the World Chapter. The Secretary, Dr. T.M. Miano, was nominated temporarily as General Coordinator of the R-o-W Chapter. Further, the Board unanimously agreed on a 25% increase of membership dues. The additional income will be entirely devoted to enhance funding for the IHSS Travel Bursaries for young scientists. The General Assembly of the IHSS, held during the 9th Meeting of the IHSS, accordingly approved.

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MEMBERSHIP DUES (2000)

Chapter/Country	Regular	Student / Retired
Argentina, Australia-New Zealand, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Indonesia, Ireland, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom, United States, Venezuela	\$ 25.00	\$ 12.50
Czech R., Developing countries (Africa, Asia, Central & South America), Egypt, Poland, Hungary, Slovakia R., Slovenia	\$ 7.00	\$ 3.00
Bulgaria, China, Latvia, Lithuania, Romania, Russia	\$ 1.00	\$ 1.00

National Coordinators should collect the fees from members of their chapters in local currencies, deduct 20-25 % out of the fees (postage, copying, etc.), and then send the balance in US \$ to the Treasurer, Dr. C.E. Clapp, Univ. Minnesota, St. Paul, MN, USA.

Coordinators from 7\$-group chapters are invited to collect dues for two years (\$14, and save converting to US \$ not so often) and are allowed to keep up to 50% of the fee. Coordinators from 1\$-group chapters can keep the entire fee.

Members of the R-o-W Chapter should send their fees directly **to the Secretary** (in US \$).

IHSS Members are reminded that membership dues are payable at the beginning of each year directly to their National Coordinators.

IHSS VOLUMES (and related publications)

HUMIC SUBSTANCES IN TERRESTRIAL ECOSYSTEMS. (675 pp). Edited by A. Piccolo. Elsevier, 1996. **ISBN 0-444-81516-3**

HUMIC SUBSTANCES IN SOIL AND WATER ENVIRONMENTS. *Characterization, Transformations and Interactions*. Proceedings 7th Int. Meeting of the IHSS. St. Augustine, Trinidad, 1994. 1996 (493 pp). Edited by C.E. Clapp, M.H.B. Hayes, N. Senesi, and S.M. Griffith and published by IHSS. **ISBN 1-889365-00-9**

THE ROLE OF HUMIC SUBSTANCES IN THE ECOSYSTEMS AND IN ENVIRONMENTAL PROTECTION. Selected Papers of the 8th Int. Meeting of the IHSS. Wroclaw, Poland, 1996. (1002 pp.). Edited by J. Drozd, S. Gonet, N. Senesi, and J. Weber. PTSH & Polish Chapter of IHSS, Wroclaw, 1997. **ISBN 83-906403-2-5**

HUMIC SUBSTANCES, PEATS AND SLUDGES: Health and Environmental Aspects. Edited by M.H.B. Hayes & W.S. Wilson. The Royal Society of Chemistry, Cambridge, 1997. Special Discount Price £38.68 (\$72.80). **ISBN 0-85404-699-2**

UNDERSTANDING HUMIC SUBSTANCES: ADVANCED METHODS, PROPERTIES and APPLICATIONS (286 pp.). Edited by E. Ghabbour and G. Davies, Royal Society of Chemistry, Cambridge, England, 1999. **ISBN 0-85404-799-9**

SPECIAL ISSUE OF *SOIL SCIENCE* - The November 1999 issue of *Soil Science* is a special issue highlighting the topic of: 'Sizes and shapes of humic molecules as fundamentally important in understanding the many basic interactions which take place in the environment'. Following an editorial by R.L. Tate, papers are presented by C.E. Clapp and M.H.B. Hayes, R.S. Swift, R.L. Wershaw, E. Tombáz, M. DeNobili and Y. Chen, I.V. Perminova, and N. Senesi. This initiative arose because of divergent views held by participants of a Workshop/Symposium sponsored by SSSA and IHSS at Anaheim, CA in October 1997. The proceedings book from that meeting "The role of humic substances in transport processes of xenobiotic organic chemicals and metals in soil and water ecosystems" will be published by SSSA early in 2000.

IN MEMORIAM

by Ludmila Sadovnikova and Olga Iakimenko, Russian Chapter of IHSS

Iana Ammosova

On March 16th 2000, the heart of Iana Ammosova stopped its beating. The charming person, good companion and the loyal friend has gone.

Iana Ammosova was born on the 24th of August 1931 in the family of remarkable statesman Maxim Ammosov. On year 1938, tragically famous in Soviet Union as the peak of Stalinism repression, her farther was illicitly put into a prison and executed and her mother was expelled from the Communist Party members. This fact stamped Iana as a daughter of the “enemy of the people” until 1956, when her farther was rehabilitated posthumously.

During the 2nd World War Iana together with her mother and sisters were evacuated to Eastern Siberia and went back to Moscow after the war. Being just a schoolgirl, she already started to work to support the family. But in spite of the difficulties she graduated from school with a golden medal and dreamed to become a physicist. She passed the exams in Moscow State University but was not accepted because she was a daughter of the “enemy of the people”. Then in 1949 Iana joined Moscow Institute of Chemistry and Technology and after graduating from it continued to work there at the Faculty of Hard Fuel. On 1963 she defended her Ph.D. thesis “Composition and properties of organic matter in coals of Yakutia”.

Iana came to the Biological Department of Lomonosov Moscow State University on 1968. During her 32 years work in Moscow University (first in Soil Science Division of Biological Department and later in Soil Chemistry Chair of Soil Science Department) Iana Ammosova passed the way from an Assistant to Senior Researcher. She became a leading specialist in the field of natural organic substances of different origin: sediments, peat, peloids, coals and soils. The scope of her scientific interests was very wide, embracing problems from molecular parameters of humic substances to the regularities of soil humus formation in natural and anthropogenic landscapes. Important part of research activity of Iana Ammosova dealt with the theoretical and methodological problems of soil pollution with organic toxicants, monitoring of oil-polluted soils, sorption of simazine by humic acids and the fate of silicon compounds in soil-plant system. Last years she investigated agro-ecological problems of application some of so called non-traditional organic fertilizers originated from waste materials: sewage sludge, technical lignin, sapropel, organic-silicon compounds and their composts. Iana Ammosova published 225 scientific papers and educated as supervisor 35 students and 7 Ph.D. students in the field of soil chemistry.

Since 1994 she was member of the IHSS and Russian Chapter Coordinator, doing her best to involve Russia in IHSS activity and to bring together Russian scientists interested in humus chemistry. To date, the Russian Chapter already enumerates 65 IHSS-members. Iana used to participate actively in scientific conferences, giving many lectures and presentations both in Russia and abroad. She visited almost all the countries of the former Soviet Union and also Bulgaria, Poland, USA, Japan, Germany, Italy and Sweden. Even last autumn, already being seriously ill, she had made bright presentations during the International Congress on Bioconversion of Organic Wastes (Ivano-Frankovsk, Ukraine) and 3rd International Conference “Humic Substances as Factor of the Terrestrial and Aquatic Ecosystems” (Bydgoszcz, Poland). Since 1998 she was a member of “Humic Substances in the Environment” Editorial Board.

Iana Ammosova was a center, a kind of catalyst for many activities. In spite of a lot of difficulties, which she had experienced in her life, Iana had always been a very kind, optimistic and clear person. Until her last days Iana kept her school and institute friendship. At the University she attended summer field excursions for students, making them not only useful, but also bright and cheerful. She liked to sing and to dance, to travel, was fond of tourism. Iana was loved not only by her close friends, but also by many people who surrounded her. And Iana replied them with the real loyal friendship, being always ready to help any person if it was wanted. She especially loved students, both her pupils and others and called them “all my children”. Iana Ammosova was a very talented Teacher, who taught students not only science, but the life attitude as well. Many of her former pupils, already being well-known specialists in their fields, used to visit Iana for advises or just to get a charge of cheerfulness and optimism from her.

Bright and clear memory about Iana Ammosova will be kept forever in the hearts of her friends, colleagues and all the people who have known her.

IHSS STANDARD AND REFERENCE COLLECTION

IHSS Team Collects Suwannee River Sample

by Michael Perdue (taken from IHSS Web site)

IHSS recently used reverse osmosis to isolate more than 1000g of natural organic matter (NOM) from the Suwannee River. This NOM is now available from IHSS for \$20 per 100mg. The sample was collected from the same site that was used originally to collect the standard Suwannee River humic and fulvic acids. The elemental composition of dry Suwannee River NOM is: 48.8 %C; 3.9 %H; 39.7 %O; 1.02 %N; 0.60 %S; 0.02 %P; 7.0 %Ash (Total 101.0%). A brief description of the sampling trip and isolation procedure follows.

From May 1 through May 9, 1999, a group representing the International Humic Substances Society (IHSS) visited the Suwannee River in south Georgia, U.S.A. to collect a new reference sample of natural organic matter (NOM). This reference NOM sample will complement the standard and reference humic and fulvic acids that were previously collected from the Suwannee River. The members of this group included Dr. James Alberts and Dr. Monika Takács of the University of Georgia Marine Institute at Sapelo Island and Dr. Michael Perdue and Ms. Lili Ding of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology.

The sample was collected at the first dam on the Suwannee River sill, on the southwestern edge of the Okefenokee Swamp near Fargo, GA. The project was authorized by the Board of Directors of IHSS, and access to the sill was granted by the Okefenokee National Wildlife Refuge in Folkston, GA. During the nine-day project, 33 concentrated samples were collected. For each sample, a 120-gallon aliquot of Suwannee River water was prefiltered successively through 1 μm and 0.4 μm polypropylene filters and concentrated to about six gallons using a RealSoft PROS/2S portable reverse osmosis system. After a concentrated sample was obtained, its temperature was maintained at or below the temperature of the river. Overall, 3960 gallons of water (about 14,990 liters) were concentrated to a final volume of 199 gallons (about 753 liters).

Because the chemical composition of the Suwannee River was expected to vary during the time required to collect the entire sample, a volume-weighted composite sample of the prefiltered Suwannee River water was prepared by collecting and combining 10-mL aliquots at periodic intervals (every 40 gallons). The composite sample, which was stored on ice at all times, had a pH of 3.93 and a TOC concentration of 39.2 mg/L (3.27 mmol/L). While a sample was being concentrated, it was circulated continuously through a cation exchange resin (H^+ -form) to remove most major cations. The "field-desalted" concentrated samples had pH values of 2.8 ± 0.1 , well below the average pH of 3.93 for the prefiltered water. During the operation of the reverse osmosis system, the permeate flow rate gradually decreased due to adsorption of organic matter on the reverse osmosis membranes. At the low pH values of the concentrated samples, the adsorbed organic matter was probably enriched in humic acids. To recover this organic matter and to increase the permeate flow rate, a single 12-liter solution of 0.01 M NaOH was used on three occasions (about once every three days) to rinse the reverse osmosis membranes. Its final pH was about 6.5.

The samples were transported to Dr. Perdue's laboratory at Georgia Tech on May 10, 1999. In the laboratory, the reverse osmosis membranes were rinsed a final time with 10 liters of 0.01 M NaOH to recover some additional adsorbed organic matter. The two NaOH rinse solutions were desalted using a cation exchange resin (H^+ -form) and then mixed into the other 33 concentrated samples. The concentrated samples were then desalted for a final time, using 250-ml columns of cation exchange resin (H^+ -form) at a flow rate of about 100 ml/min. A volume-weighted composite sample was prepared from the desalted, concentrated samples. Its pH was 2.54 and its TOC concentration was 725 mg/L (60.4 mmol/L). From the volumes and TOC concentrations of the prefiltered water and the final concentrated samples, the percent recovery of organic carbon was calculated to be 92.9%. During the three weeks that the samples were being processed in Dr. Perdue's laboratory at Georgia Tech, they were stored in a cold room at 4-6 °C. For two days, while the cold room was not operational, the samples were cooled with ice.

On May 31, the 31 carboys of desalted, concentrated samples were shipped by truck to Van Druenen Farms in Momence, IL, where they were stored in a cold room until an IHSS representative could arrive to supervise the freeze-drying process. Finally, on June 7-9, the samples were freeze-dried under the supervision of Dr. Perdue. Approximately 1060 g of freeze-dried natural organic matter was obtained. The freeze-dried product was transferred back to Georgia Tech for pulverization, homogenization, and final drying.

New e-mail Address. Effective 1 June 1998, the e-mail address for communication concerning the collection is IHSS@soils.umn.edu. E-mail is the preferred method of communication for ordering from the IHSS collection. For more details see the IHSS web site at www.ihss.gatech.edu.

MEETINGS

10th International Meeting of the International Humic Substances Society, Toulouse, France, July 24-28, **2000**. IHSS 10 "Entering the Third Millenium with a common approach to Humic Substances and Organic Matter in Water, Soil and Sediments". The 10th conference of our Society will bring together scientists from many fields, interested in not only humic substances but all organic matter. It therefore provides a forum for multidisciplinary discussion between researchers working on topics as different as chemistry, geochemistry, thermodynamics, agriculture and biology, water treatment, environment and health matters. The mechanisms of formation of organic matter and humic substances, their characterisation, properties and interactions with other components of their environment will all be covered, as well as the industrial applications of humic substances. This 10th Conference of IHSS is being organised by the French chapter of the IHSS. A keynote lecture will be given by Y. Tardy (ENSAT) during the opening session on the emerging topic "Thermodynamics of humic substances and organic matter". The conference will take place over five days, with four days of scientific programme and one day with a technical and cultural excursion. Conference Secretariat : PROGEP - Florence FOUCAUD, "IHSS 10", 18, Chemin de la Loge, 31078 Toulouse Cedex 4 (France), Tel : +33 (0)5 62 25 23 80 - Fax : +33 (0)5 62 25 23 18, E-mail : Progep@ensigct.fr



II ROSE Conference on Refractory Organic Substances in the Environment, Karlsruhe, Germany, August 1-3, **2000**. The Rose Conference will be held at the University of Karlsruhe right after the IHSS Conference in Toulouse. At the end of a major research program supported by the Deutsche Forschungsgemeinschaft (DFG) since 1994, we want to present, in conference format (ROSE II), the most interesting achievements of the different projects in an international context after having discussed some of the results during the ROSE I conference in 1997. Don't miss the chance to join us in exchanging the most recent scientific findings on the structure and function of ROSE. The exciting results, an attractive campus and

its magnificent surroundings, and last but not least, the experience with ROSE I make me optimistic that we will enjoy a stimulating and rewarding conference. Papers and Poster presentations are welcome. Registration fee is DM 450.- (early registration until 15.3.2000: DM 400.-); student's rate is DM 250.-. Deadline for abstracts March 15, 2000; deadline for registration and payment July 1, 2000.

Further information: Prof. Dr. Fritz H. Frimmel and Dr. Gudrun Abbt-Braun, Engler-Bunte-Institut, Universität Karlsruhe, D-76128 Karlsruhe, GER. Phone: +49(0).721.608.2580; Fax: +49(0).721.699.154.

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Northeastern Seminar on Humic Substances V, Boston, MA, USA, March 21-23, **2001**. Call for Papers. Humic substances are the brown biopolymers in sediments, soils and water. They form colloids and have fantastic surface properties (e.g. with clays) and unique characteristics. Their properties and important environmental roles justify detailed study as molecules and materials. A growing number of companies is supplying humic products for agricultural and environmental applications. Papers on the structures, properties and applications of humic substances are invited. New work only, please. The proceedings will be published. Registration limited to 120: US Residents \$150, all others \$125 and certified students \$100. Only 25 slots are available for the exhibition of products and services. Special nearby hotel rates available. Deadline for abstracts and registration December 30, 2000. For additional information please contact Dr. Elham Ghabbour, Barnett Institute, 341 Mugar Hall, Northeastern University, Boston, MA 02115, USA. Phone 6173737988; fax 6173732855; e-mail eghabbou@lynx.neu.edu; www.hagroup.neu.edu

PAST MEETINGS

III Brazilian Meeting on Humic Substances

by Ladislau Martin-Neto

The Brazilian Chapter of IHSS promoted in November, 24-26, 1999, the III Brazilian Meeting on Humic Substances, held in Santa Maria, State of Rio Grande do Sul, Brazil. The Meeting was successfully organized by Department of Soils from Federal University of Santa Maria with Chair Dr. Carlos A. Ceretta and Executive Secretariat Dr. Marcos Rubens Fries. More than 200 researchers, from different areas, including soil science, chemistry, physics, biology and environmental science, participated in the Meeting with 78 voluntaries papers, presented in poster sessions, and 15 invited Conferences rendering an Abstract book with 383 pages. Certainly this Meeting was very important to consolidation of Brazilian Chapter of IHSS considering both quantitative and qualitative aspects. There were five international speakers, Alessandro

Piccolo, (University of Napoli, Italy), Peter Burauel (Institute of Chemistry and Dynamics of the Geosphere 5: Radioagronomy, from Julich, Germany), Donald C. Reicosky (USDA-ARS, Minnesota, USA), Christian Feller (IRD (ex-Orstom), Montpellier, France) and Adrian Andriulo (INTA, Pergamino, Argentine), and nine Brazilian speakers, Arquimedes Lavorenti, Érico Flores, Pedro A. Selbach, Eduardo de Sá Mendonça, Pedro Machado, Cimélio Bayer, Wanderley J. de Melo, Júlio C. Rocha and Ladislau Martin-Neto. The IV Brazilian Meeting on Humic Substances will be held in Viçosa, Minas Gerais (central region of Brazil), in November, 2001, with Chair Dr. Eduardo de Sá Mendonça.

Humic Substances Seminar IV, Northeastern University, Boston, MA, USA

by the Humic Acid Research Group

Humic Substances Seminar IV was held on March 22-24, 2000 at the Northeastern University, Boston, USA. The Seminar was dedicated to Frank J. Stevenson, former Professor of Soil Science at the University of Illinois and an Honorary Member of IHSS. The Honorary Chair was Michael Hayes of the University of Limerick and the Honored Guest was Morris Schnitzer who (with Dr. Stevenson) received the Wolf Prize for Agriculture in 1996. Also very welcome was Robert Wershaw (USGS, Denver), who prompted HSs Seminar I and was Honorary Chair of Seminar II in 1998. Greetings from Fritz Frimmel (President, IHSS) and Donald Sparks (President, Soil Science Society of America) were read. The Honorary Chairs of Seminars I (Wolfgang Ziechmann) and III (Cornelius Steelink) were recognized. Also participating were IHSS Past President James Alberts, President-Elect Yona Chen, Past Presidents Michael Hayes and Nicola Senesi, newly elected Board Member Maria De Nobili and the IHSS Coordinators of Canada, Egypt and USA (Ming Huang, Elham Ghabbour and James Rice).

Industrial interest in the Seminars is growing. Seminar IV featured an Exhibit by the following organizations: Arcotech, Inc. (Chantilly, VA, D. Walia), Biomin, Inc. (Ferndale, MI, G. Alther), Fisher Scientific LLC (Suwanee, GA, M. Clifford), Horizon Ag-Products, Inc. (Kennewick, WA, D. King), Humate International, Inc. (Jacksonville, FL, B. Galbraith), US Chapter, IHSS (J. Rice), Live Earth Products (Emery, UT, R. Taylor), Micromass UK Ltd (Manchester, D. Churchman), Royal Society of Chemistry (Cambridge, UK, R. Andrews), Springborn Laboratories, Inc. (Wareham, MA, J. Hoberg), U-Mate International, Inc. (Scottsdale, AZ, D. Jones) and USDA-NRCS- National Soil Survey Center (Lincoln, NE, H. Smith). A full day of HSs applications papers was included in the program of 36 presentations with nearly 100 authors from 16 countries.

We followed the sequence HSs Formation, Characterization, Separation, Solute Sorption, Metal Binding, Coal-derived HSs and Applications. Two topics of high current interest were HSs aggregation and redox chemistry, as presented by leaders of these fields. The work ranged from aqueous NOMs to solid HAs. The program and abstracts are available at <www.hagroup.neu.edu>. The proceedings will be published as the book *Humic Substances: Versatile Components of Soil and Water*, E. A. Ghabbour and G. Davies, Eds., by the Royal Society of Chemistry in November 2000. Each paper will be abstracted by Chemical Abstracts. Research presented at Seminar IV by the individuals named is summarized below.

R. Wershaw recommended detailed HSs formation studies rather than seeking structures of transient (even in geological time) HSs. M. Huebner reviewed evidence for free radical humification process components. M. Schnitzer reported that composted duck farm-bedding waste mostly consists of holocelluloses, lignins, phenolic esters and lipids (with sterols prominent). Lipid components may favor HSs aggregation. He emphasized studies of whole samples rather than isolated HSs fractions. Y. Chen reported that according to ^{13}C NMR data, HAs from composted cattle manure and municipal solid waste have increased carboxylic acid and aromatic content and decreased aliphatic character and carbohydrate content. P. M. Huang compared the products of catechol air-oxidation catalyzed by aqueous hydroxoaluminum at acid pH with the IHSS standard HA. L. Tremblay (winner of the *Best Graduate Student Presentation Award*) described a rapid diffuse reflectance-IR-Fourier transform (DRIFTS) method to measure the FAs and HAs contents of dried, ground sediment samples.

DRIFTS and cross polarization/total sideband suppressed ^{13}C NMR spectra were used by G. Ding to compare HSs products from different cover systems. K. Thorn used ^{15}N spectroscopy to follow coupling to soil components of amine products from soil transformed TNT. Quantitative ^{13}C NMR spectroscopy benefits from variable contact time measurements to help correct the HSs spectra, as reported by B. van Lagen. Two-dimensional $^1\text{H}/^{13}\text{C}$ (HETCOR) sub-spectra described by J. Mao are easier to interpret than conventional data. M. Hayes reported that HPLC with modified eluents that disfavor molecular associations

decreases the polydispersity of HSs fractions. He confirmed that 2-D HETCOR is giving new HSs connectivity and structural clues. A. Piccolo reported that peroxidase treatment of supramolecularly associated HSs causes polymerization and earlier elution of the products from HPSEC columns. M. De Nobili said that more work with electrophoretic methods based on charge density and diffusion will resolve questions of high or low HSs molecularity. M. Aoyama, who is identifying fluorescent "impurities" in HSs samples and their possible origins addressed a fundamental question in HSs photochemical work. J. Rice uses X-ray and laser light scattering to show that HSs aggregation results in little change of predominantly fractal, pseudo-spherical particle morphology. G. Haberhauer uses statistical cluster analysis to improve the information content of HSs mass spectral data.

J. Van Stempvoort found fast and slow Aldrich HA adsorption on a coarse, carbonate rich model aquifer solid, followed by Langmuir behavior at equilibrium. The products retard Cu(II) and PAH mobility in a pilot scale aquifer. This theme was continued by J. Poerschmann, who demonstrated how HSs sorption is activated by treating aquifer materials with iron(III) and aluminum salts. J. Kochany reported that HSs catalyze phenol and formaldehyde removal from water and can support biological activity of raw activated sludge if no other food source is available, as indicated by respirometric measurements. L. Carlsen described multivariate analysis of factors favoring sorption of esfenvalerate (a hydrophobic, highly toxic insecticide) by DOMs of different origin. N. Senesi described how endocrine disrupters bisphenol A (BPA) and ethynil estradiol (ED) are sorbed by six different HAs. The data follow the Freundlich relation. Reversible sorption of ED is much more extensive than for BPA. Aniline interacts most strongly with a soil fulvic acid at pH 5.0, as indicated by fluorescence quenching data reported by C. Coolidge. The results suggest an electrostatic interaction in the most favorable quenching conformation.

D. Amarasiriwardena has coupled flow field-flow fractionation to inductively coupled plasma-mass spectrometry to create Flow-FFF-ICP-MS, which gives monomodal fractograms (apparent $M_w \approx 5$ kDa for five different HAs) with different polydispersities containing trace metals. Increased splitting of the first-derivative X-ray absorption near-edge spectra (XANES) of Cu-HSs complexes at high pH reported by G. Korshin indicates tetragonal distortion presumably due to competing OH^- coordination. G. Buckau stated that because of counterion inclusion, only a fraction of proton exchanging HSs functional groups can be loaded with metal ions and that the complexation strength and counterion inclusion correlate. D. McKnight described the effects of Fe-HS complexes on photochemical reductive dissolution of iron oxides and as electron shuttles to iron(III) oxides, which fractionate more aromatic HSs components according to NMR data. Quinoid triplets are key products of HSs photochemistry, as indicated by comparison with a benzoquinone/hydroquinone/phenol (3:3:1) model in work described by C. Langford.

The elemental analyzer-isotope ratio mass spectrometry principle described by J. Morrison is a very powerful tool in plant physiology, environmental science and soil chemistry. The most telling measurement for mechanistic purposes is H/D ratios. G. Buckau reported for 11 co-authors the results of an EU-funded study of HSs effects on radionuclide migration. Radionuclides are essentially irreversibly bound by NOMs in natural systems, which is a big factor in system models. G. Alther gave a fascinating account of how swellable clays like bentonite can be modified with quaternary amines to exchange anions and remove Cl_2 and HSs from water. J. Alberts described how acidification causes Norwegian lake NOM to lose oxygenated aromatic fragments and make metal loaded NOM more toxic towards the bacterium *Vibrio fischeri*. G. Korshin presented the complicated kinetics of Cl_2 reactions with the hydrophobic fraction of Suwannee River NOM, and with resorcinol and 3,5-dihydroxybenzoic acid as HSs models.

HA technology in the Czech Republic was well represented by HA materials extracted from capucine, a waste material in coal production and oxyhumolite, an oxidized brown coal, as reported by D. Gajdošová and L. Pokorná. These materials have more than one feature in common with soil-derived HAs. A. Fataftah described Humasorb™, a cation exchanger that also sorbs organics, destroys chlorinated soil/water products, is insoluble in water and can be modified to exchange anions. K. Day, a pre-eminent consultant, reported that HA products are increasingly being applied in agriculture, especially to prevent tie-up of phosphorus by calcium and by iron and aluminum minerals.

Humic Substances Seminar IV was sponsored by Arctech, Inc., US Chapter of IHSS, The Royal Society of Chemistry, Fisher Scientific LLC, the Barnett Institute and the College of Arts and Sciences at Northeastern University.

Humic Substances Seminar V will be held at Northeastern Mar. 21-23, 2001. The Honorary Chair is Dr. C. E. Clapp of the University of Minnesota. The registration and abstracts deadline is Dec. 30, 2000 (see <www.hagroup.neu.edu>). See you there!!!!