

### BIO-DATA

Name : DR. UMA SANKAR SARMA  
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Date of Birth : 12<sup>th</sup> April, 1951.  
Permanent Address : Duplex Flat No. 3A, Block F,  
Madhuwan Enclave,  
Alkapuri, Ohadpur  
Gwalior  
PIN- 474 003,  
Madhya Pradesh.

### EDUCATIONAL QUALIFICATIONS

Examination Passed	Board/University	Year	Class/Division
Higher Secondary	West Bengal Board of Secondary Education	1968	1 <sup>st</sup> Division
B. Sc. (Chemistry Honours)	Jadavpur University	1971	2 <sup>nd</sup> Class
M. Sc. (Organic Chemistry)	Jadavpur University	1974	1 <sup>st</sup> Class
Ph. D. (Chemistry)	Calcutta University	1982	By Thesis-"Studies on Fibre Hemicelluloses"

### INDUSTRIAL RESEARCH EXPERIENCE

(1975-85) – Worked in the R&D Laboratory of New Central Jute Mills Co. Ltd., Budge Budge, West Bengal on the aspects of bleaching, dyeing and finishing treatments on jute and allied fibres and fabrics.

### DOCTORAL RESEARCH EXPERIENCE

(1978-82) – Got Ph. D. degree on the thesis, "Studies on Fibre Hemicelluloses", in which worked on the chemistry of natural textile fibres, like Pineapple, Jute and Sansevieria. The work was done at the Indian Association for the Cultivation of Science [IACS], Kolkata and New Central Jute Mills Co. Ltd., and degree was awarded by the University of Calcutta in the year **1982**.

### POST DOCTORAL FELLOWSHIP IN FRANCE

(1984-85) – Worked on the Lignin Carbohydrate Complexes of normal and Mutant Rice Straws at the *Institut National de la Recherche Agronomique* (INRA), Nantes, France on a one year Post Doctoral Fellowship awarded by the Ministry of Agriculture, Govt. of France and published a paper in the International Journal, "Agronomie".

### EXPERIENCE AT DRDO

(1986-89) – Selected by CSIR for placement in the Scientist's POOL as a class I officer [A scheme for the scientists who return from abroad] and was posted at the Defence Research and Development Establishment (DRDE), Gwalior, M.P.

Worked on the aspect of preparation of semi-permeable protective clothing for highly toxic environment and published research papers in reputed national journals.

### UNDP PROJECT EXPERIENCE

(31<sup>st</sup> March, 1989-30<sup>th</sup> April, 1992) – Worked on the project, “Chemical Softening of the fibres for better spinnability and production”, at Indian Jute Industries’ Research Association [IJIRA] (UNDP Assisted Project), Kolkata and the process was implemented in the jute industry.

### NATIONAL AWARDS

1. **23<sup>rd</sup> March, 2012** - Received NRDC (National Research Development Corporation) Award, Govt. of India, for the Meritorious Invention of “Mobile Coir Fibre Extraction Machine” which was presented by His Excellency Mr. Kenneth Viagem Marizane, Vice Minister of Trade and Industry, Mozambique at Mumbai.
2. **23<sup>rd</sup> April, 2012** - PSN Trust National Award for Excellence in Science and Technology, Thirunelveli, has been conferred to Dr. U. S. Sarma and his team of scientists and technologists for the development of Mobile Coir Fibre Extraction Machine (SWARNA). The award consists of Rs. 50,000, a medal and a shield for the Central Coir Research institute.
3. **29<sup>th</sup> June 2010** – The Coir Board in its 201<sup>st</sup> Board Meeting held at Kochi, had given cash award of Rs. 120,000 to Dr. U. S. Sarma and his team of scientists and technologists for developing the Mobile Fibre Extraction Machine (SWARNA) to meet the scarcity of coir fibres and to enhance the utilization of husk in the country.
4. **9<sup>th</sup> November, 2006** - Received Commemorative Award instituted by Indian Chapter of IGS [International Geosynthetic Society, USA] that was presented in New Delhi in appreciation of contribution to development and promotion of geosynthetics in India.
5. **29<sup>th</sup> June, 2004** - Received NRDC (National Research Development Corporation) Award, Govt. of India, for the Meritorious Invention of Metallic Handloom-“Anugraha” which was presented by Shri. Kapil Sibal, Hon’ble Minister for Science & Technology, Govt. of India. His Excellency the then President of India Dr. A. P. J. Abdul Kalam was the Chief Guest of the function.
6. **5<sup>th</sup> November 2004** - Received “Rajabhasha Shri Samman” from Bharatiya Rajabhasha Vikas Sansthan, Dehradun, at the valedictory function of the Seminar held at Puducherry, which was presented by His Excellency the Lieutenant Governor of Puducherry, Shri. M. M. Lakhera.
7. **11<sup>th</sup> May 2002** – Received a Meritorious Invention Award instituted by NRDC, Govt. of India, which was presented by Shri. K. C. Pant, Deputy Chairman, Planning Commission, Govt. of India, on the Technology Day for, “COCOLAWN™ - A Readymade Lawn”.
8. **11<sup>th</sup> May 1999** - Received a Meritorious Invention Award instituted by NRDC Govt. of India, which was presented by Dr. Murali Manohar Joshi, Hon’ble Minister for HRD & S&T, Govt. of India, on the first Technology Day for, “Reducing the period of Retting of Coconut Husk and upgrading the quality of unretted green husk fibres by treatment, using bacterial cultures”.

### INTERNATIONAL AWARD

**The W I P O (World Intellectual Property Organization, Geneva) GOLD MEDAL** has been conferred for the invention of Mobile Fibre Extraction Machine as the best invention of the year 2010. The medal was presented to Dr. U. S. Sarma as team leader on 23<sup>rd</sup> March, 2012 at Mumbai by His Excellency Mr. Kenneth Viagem Marizane, Vice Minister of Trade and Industry, Mozambique.

## **RESEARCH**

Dr. U. S. Sarma, Director, R.D.T.E. [Research, Development, Training & Extension] has worked as the Executive Head of three institutes namely, CCRI, CICT and NCT&DC since he joined the Coir Board on 1<sup>st</sup> May, 1992.

He has retired on superannuation on 30<sup>th</sup> April, 2013 since then he has worked as Advisor (R&D) for the Coir Board till 30th June, 2014.

## **INTERNATIONAL PROJECTS**

- Implemented an UNDP project on “Modernisation, Technology Transfer and Capacity Building in /Coir Industry”, at CCRI from January 2000 to December 2002.]
- Implemented a 3 years’ Food & Agricultural Organization (FAO) Project funded by Common Fund for Commodities ([CFC] as National Project Director(N.P.D.) at the CCRI for development of Softening, Bleaching, Dyeing and Printing of coir from 1995 to 1998.

## **RECOGNIZED RESEARCH GUIDE**

1. Cochin University of Science & Technology has recognized Dr. U.S. Sarma as a Research Guide at CCRI for conducting works towards Ph.D. Degree (2006).
2. Mahatma Gandhi University, Kottayam has recognized Dr. U.S. Sarma as a Research Guide at CCRI for conducting works towards Ph.D. Degree (2007).

## **MEMBERSHIP OF PROFESSIONAL BODIES**

1. Member, Executive Committee, International Natural Fibre Organization [INFO], The Netherlands.
2. Member, International Erosion Control Association [IECA], USA
3. Member, International Geosynthetics Society [IGS], USA
4. Chairman, Coir & Coir products, Sectional Committee, Bureau of Indian Standards [BIS], TXD 25
5. Member, Geotextiles and Industrial Fabrics, Sectional Committee, Bureau of Indian Standards [BIS], TXD 30
6. Member, Cordage Sectional Committee, Bureau of Indian Standards [BIS], TXD 9.
7. Member, RAC, CIRCOT, Mumbai

## **Editorial Board Member**

CORD, International R & D Journal published by Asian and Pacific Coconut Community (APCC), Jakarta, Indonesia

## **Deputations abroad**

Has been deputed to various International Conferences in USA, Europe, New Zealand, Jamaica and Middle East for participation & presentation of papers.

## LIST OF PUBLICATIONS/PRESENTATIONS

### INTERNATIONAL

1. "Investigation on the structure of the hemicellulose obtained from the fibre of Sansevieria Trifasciata Leaves", by U.S.Sarma and A.K.Mukherjee, Carbohydrate Research, 95 (1981) 81-86.
2. "Investigations on the fibres of Pineapple (Ananas Comosus (L) Merr.) Leaves", by U.S.Sarma, Carbohydrate Research, 97(2) (1982) 323-329.
3. "Investigation on the structure of the hemicellulose obtained from the fibre of Sanservieria Trifasciata Leaves Part II", by U.S.Sarma and A.K.Mukherjee, Carbohydrate Research, 105(2) (1982) 247-250.
4. "Investigation on the fibres of Pineapple (Ananas Comosus (L) Merr.) Leaves: Structural study of the hemicellulose", by U.S.Sarma, Carbohydrate Research, 111 (1982) 151-155.
5. "Kinetics of oxidation of D-glucose by Hexachloroiridate and Tetrachloroaurate (III)", by K.K.Sen Gupta, S.Sen Gupta, U.Chatterjee, A.Tarafdar, T.Samanta and U.S.Sarma, Carbohydrate Research, 117(1983) 81-87.
6. "Studies on a brittle stem mutant of rice, Oriza sativa L., characterisation of Lignin fractions, associated phenolic acids and, polysaccharides from rice stem", by U.S.Sarma, J.M.Brillouet, A.Scalbert and B.Monties, "Agronomie", 6(3), (1986), 265-271.
7. "Bioinoculants for Coir Retting" by Anita Das Ravindranath and U.S.Sarma, Cord 2 (1) (1995), 34-40.
8. "Retted (White) Coir Fibre Nettings – The Ideal Choice as Geotextiles for Soil Erosion Control" by K.George Joseph and U.S.Sarma. Presented and published in the Proceedings of the International Erosion Control Association's 28<sup>th</sup> Annual Conference, Tennessee, USA held on 25-28, February, 1997, 67-76.
9. "Rural progress through value addition in coir", by U. S. Sarma, presented on 8 May, 2003, at the International Coconut Summit 2003, held at Kochi from 7-11 May, 2003.
10. "Effect of random inclusion of fiber in the volume change behaviour of cochin marine clay", S. Cyrus, U. S. Sarma, B. T. Jose, 2<sup>nd</sup> International Conference on Problematic Soils, 3-5 December 2006, Petaling, Selangor, Malaysia.
11. "Determination of kinetic and equilibrium parameters of the batch absorption of Co (II), Cr (III) and Ni (II) onto coir pith," by H. Parab, S. Joshi, N. Shenoy, A. Lali, U. S. Sarma and M. Sudersanan, Process Biochemistry, 41 (2006), 609-615.
12. "Application of eco-friendly coir geotextiles for canal/river bank protection", A.C. Jose, U. S. Sarma, K.R. Anil, and M. Kumaraswamy Pillai , Poster presentation in the Annual Conference of International Erosion Control Association, 2006 at California, Feb. 21-24.
13. "Versatile Coir geotextiles", A. C. Jose and U. S. Sarma, Poster presentation in the Annual Conference of International Erosion Control Association, 2007, at Reno, Nevada.
14. "A novel method for accelerated composting of coir pith- an agro-industrial residue", P.K. Ghosh, U. S. Sarma, Anita Das Ravindranath, S. Radhakrishnan and Prasenjeet Ghosh", Energy & Fuels, 21 (2) (2007), 822-827.
15. "Application of a coir geotextile reinforced mud wall in an area below sea level at Kuttanad, Kerala", U. S. Sarma and A. C. Jose, has been presented, which has been published in the Proceedings of the Annual Conference of International Erosion Control Association, 2008 held at Orlando, Florida, Feb. 18-22.
16. "Esterified oir pith as an adsorbent for the removal of Co (II) from aqueous solution," H. Parab, S. Joshi, N. Shenoy, A. Lali, U. S. Sarma and M. Sudersanan, Bioresource Technology, 99 (2008), 2083-2086.
17. "Coir based soil less natural grass-instant lawn for soil erosion control", U. S. Sarma and Sesh Kumar Pulipaka. Presented and published in the Proceedings of the Annual Conference of International Erosion Control Association, held at Reno, Nevada, USA, February, 9-12, 2009.
18. "Prevention of soil erosion through vegetation of mine dumps using coir geotextiles", U. S. Sarma, Sesh Kumar Pulipaka and V. S. Vijayaraghavan. Presented and published in the Proceedings of the

Annual Conference of International Erosion Control Association, held at Dallas, Texas, February, 16-20, **2010**.

19. "Metal coated coir fiber for smart textile applications", Melvi Chandy, M. S. Latha, K. Shreekrishna Kumar, and U. S. Sarma, *Cord*, 26 (1) (**2010**) 30-38.
20. "Phytosanitation of coir pith by irradiation with <sup>60</sup>Co", M. S. Lata, K. Sheekrishnakumar, Anita Das Ravindranath, Arun Sharma and U. S. Sarma, presented as an invited Speaker at the International Conference organized by National Association for Applications of Radioisotopes and Radiation in Industry (NAARRI) at Hotel Renaissance, Powai, Mumbai, December, 13-15, 2010 and published in the proceedings of NAARRI International Conference-2010 (NIC-2010), Vol. I, INVITEDTALKS, (**2010**), 158-165.
21. "Prospects and problems of use of coir geo-textiles for soil conservation work in forest area", U. S. Sarma, A. K. Bisaria, Sesh Kumar Pulipaka, and V. S. Vijayaraghavan, presented and published in the Proceedings of the Annual Conference of International Erosion Control Association, held at Orlando, Florida, February, 20-23, **2011**.
22. "Enhancement of properties of coir geotextiles by natural rubber latex coating," Lekshmi Nair, P. K. Ravi and U. S. Sarma, *Cord*, 27 (1), (**2011**), 1-8.
23. "Azolla & Soya Hulls-Substitutes for urea in coir pith composting using *Pleurotus Sajor Caju*," Radhakrishnan S., Anita Das Ravindranath, Sarma U. S., Jayakumaran Nair A., *Cord*, 27 (2), (**2011**), 46-55.
24. "Application of coir geotextiles in rural roads", U. S. Sarma and Anita Das Ravindranath, presented and published in the Proceedings of the Annual Conference of International Erosion Control Association, held at Las Vegas, February, 26-29, **2012**.
25. "Quantitative Evaluation of the Production of Lignolytic Enzymes-Lignin Peroxidase and manganese Peroxidase by *P. Sajor Caju* During Coir Pith Composting", S. Radhakrishnan, Anita Das Ravindranath, M. S. Hanosh, U. S. Sarma and A. Jayakumaran Nair, *Cord*, 28(1), (**2012**), 24-32.
26. "Nanocellulose from diseased coconut wood biomass," Jayaraj A. P., Anita Das ravindranath, and Sarma U. S., *Cord*, 30(1), (**2014**), 1-10.

#### LIST OF PUBLICATIONS/PRESENTATIONS

##### NATIONAL

1. "Fire-retardancy of jute fabrics with potassium sodium tartarate (Rochelle Salt)", by U. S. Sarma, "Colourage", 32(26) (**1985**) 19-20.
2. "Modification of the IJIRA Process of stabilised bleaching of jute fabrics", by U. S. Sarma, "Colourage", 32(26) (**1985**)19-20.
3. Presented a review on the "Lignin –Carbohydrate complex of natural fibres", by U. S. Sarma at the seminar on the 24<sup>th</sup> Annual General Meeting of the Textile Association of the India (West Bengal Unit), held on September 8, 1985, the part of which has been published in "Textile Trends" 28(6) (1985) 98: 28(8) (**1985**) 43-45.
4. "Effect of anions in Cu (II) diamine complexes on catalytic hydrolysis of DFP", by D. N. Marjit, U. S. Sarma, and D.K.Jaiswal, "Current Science" 57 (**1989**) 958-960.
5. "Hydrolysis of diisopropyl phosphorofluoridate catalysed by copper (II) – diamine complexes", by D. N. Marjit and U. S. Sarma, *Indian J. Chemistry*, 28 A (**1989**) 958-960.
6. "HPLC study on the hydrolysis of parathion catalysed by Cu (II) – diamine complexes", by U. S. Sarma, D. N. Marjit, D. K. Dube and S. K. Raza "Indian Journal of Chemistry", 29A (**1990**) 800-802.
7. "Study on the efficacy of CC-2 and Fuller's earth combination as a decontaminant against sulphur mustard (mustard gas) dermal intoxication in mice", by U. S. Sarma, P. Kumar and R. Vijayaraghavan, *Defence Science Journal*, 41, No.4 (**1991**) 363-366.
8. Presented a paper entitled "Technology Alternations in Coir Industry", by U. S. Sarma in the Seminar, "The Coir Industry in Kerala – a study on the modernization and employment protection" held at Trivandrum on 12-13<sup>th</sup> November **1992**.

9. "Extraction of Lignosulphonates from Coir Pith – An agrowaste", by U. S. Sarma and Anita Das Ravindranath, Proceedings of the Workshop on utilisation of Coir Pith, **1993**, P. 11-13.
10. "Biotechnology – A new avenue in Coir Research", by Anita Das Ravindranath and U. S. Sarma, COIR, 37, No.1, January- June **1993**.
11. "Bioinoculant Treatment of Unretted Green husk Fibre for Quality Improvement", by Anita Das Ravindranath, U. S. Sarma, COIR, 37, No.2, July-September, **1993**.
12. Presented a paper entitled "Coir Geotextiles and its Applications", by U. S. Sarma, in the 2<sup>nd</sup> International Workshop on Geotextiles Organised by the Committee for International Geotextiles Society (India) held at New Delhi on 11-12 January, **1994**.
13. "German Ban – an eco-friendly prescription for the coir industry", by U. S. Sarma, Coir News, Vol. 24, No.5, May 20, **1995**, P.25-36.
14. A paper entitled "Research and Development on Coir Technology", by U. S. Sarma was presented at the Eighth Kerala Science Congress held at Kochi on 27-29, January **1996**.
15. A paper entitled "Manifold Potentials of Coir Geotextiles", by U. S. Sarma and M.Kumararaja was presented at the "Seminar on Coir Geotextiles" held at Alleppey, has been published in the Coir News, Vol.26, No.4, April 20, **1997**, P.27-30.
16. "Eco Friendly & Versatile Coir Geotextiles", by U. S. Sarma, Geosynthetic Asia'97, Vol. I, 26-29 Nov.1997, Bangalore, India, Eds, C. V. J.Varma, G. V. Rao and A. R. G.Rao, Publishers, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, Session VI, P.49, **1997**.
17. "Studies on Imparting Softness to Coir Fibre/Yarn", by I. R. Anto, P. K. Ravi and U. S. Sarma, Proceedings of the International Workshop on Wet Processing of Coir, 8-9 Dec.**1997**, Alleppey, India.
18. "Investigations in Bleaching of Coir", by I. R. Anto, T. Ravindran, P. K. Ravi, M. Kumaraswamy Pillai and U. S. Sarma, Proceedings of the International Workshop on Wet Processing of Coir, 8-9 Dec.**1997**, Alleppey, India.
19. "A Study on Bleaching of Coir using Bacterial Cultures", by Anita Das Ravindranath, S.Radhakrishnan and U. S. Sarma, Proceedings of the International Workshop on Wet Processing of Coir, 8-9 Dec.**1997**, Alleppey, India.
20. "Techniques of Dyeing Coir Materials", by K. G. Mohanan, P. C. Antonel Vaz, J. Sunil Dath, A. Radhakrishnan, V. A. Sebastian and U. S. Sarma, Proceedings of the International Workshop on Wet Processing of Coir, 8-9 Dec.**1997**, Alleppey, India.
21. "Printing of Designs on Coir Materials", by A. Radhakrishnan, V. R. George Roy and U. S. Sarma, Proceedings of the International Workshop on Wet Processing of Coir, 8-9 Dec.**1997**, Alleppey, India.
22. "Application of Microorganisms to Enhance Biodegradation of Phenolic Compounds and to Improve Retting of Coir", by Anita Das Ravindranath and U. S. Sarma, Journal of Scientific and Industrial Research, Vol.57, Oct. & Nov., **1998**, P. 825-827.
23. "Coir exports and eco regulations in Germany", by U. S. Sarma, Coir News, Vol. XXIX, No. 10, October 20, **2000**, P. 15-19.
24. "Softening of Coir", by U. S. Sarma, Souvenir P. 103-109, published by Coir Board on the occasion of inauguration of the India International Coir Fair (IICF) and Seminar held on 11<sup>th</sup> to 13<sup>th</sup> October **2001** at Le Meridien Covention Centre at Kochi.
25. "Recent advances in the processing of coir", by U. S. Sarma, presented at the National Seminar on "Recent advances in natural fibre research", organized by Indian Fibre Society (IFS) in collaboration with Central Research Institute for Jute and Allied Fibres (CRIJAF)", on 15-16 December, **2001** at CRIJAF, Barrackpore, West Bengal.
26. "Coir retting: Its influence in the Vembanad and Ashtamudi wetlands of Kerala", by Anita Das Ravindranath and U. S. Sarma, presented at the "Regional Seminar on Ramsar Sites of Kerala", held at Centre for Water Resources Development & Management, Kozhikode, on 21 February, **2003**.
27. "Coir Bhoovastra for soil bio-engineering applications", by U. S. Sarma, presented at the National Seminar on Coir Bhoovastra organized by Coir Board at New Delhi, on 21 March, **2003**.

28. "Evaluation of bacterial treatment on the Flexural Rigidity and Light fastness properties of coir fibre", by Anita Das Ravindranath & U. S. Sarma (2004), Coir News Golden Jubilee Special Issue, August **2004**, 22.
29. "Coir Fibre Extraction and coir pith composting biotechnology", by Anita Das Ravindranath, U. S. Sarma and S. Radhakrishnan (2005) Paper presented at the National Workshop on Women Friendly Technologies, Kochi Jan 20-22, **2005**.
30. "Spinning of coir/jute blended yarns in modified jute spinning system", K. P. Chellamani, Debasis Chattopadhyay and U. S. Sarma, Asian Textile Journal, April, **2006**, p 66-69.
31. "Focused Approach to New Dimensions in Coir Industry during 11th Plan", by U. S. Sarma (**2006**) paper presented at the National Seminar-cum-Exhibition held at New Delhi on 06.10.06.
32. "Versatile Coir Geotextiles" paper presented at the International Seminar on "Geosynthetics in India- Present and Future", by U. S. Sarma at New Delhi from 8<sup>th</sup> to 10<sup>th</sup> November **2006**.
33. "Applications of Geosynthetics-Use on Roads subgrades", by U. S. Sarma paper presented at the Workshop on Applications on of Geosynthetics-Present and Future" at Ahmedabad from 20-21<sup>st</sup> September **2007**.
34. "Research & Development in Coir", by U. S. Sarma, paper presented at the "Bharatiya Vigyan Sammelan-2007 on 23<sup>rd</sup> November, 2007 – "A national level Sammelan on Science & Technology" at Bhopal from 23<sup>rd</sup> to 25<sup>th</sup> November **2007**.
35. "Biotechnology in Coir- Past, present and future", Anita Das Ravindranath, U. S. Sarma and S. Radhakrishnan, India International Coir Fair 2007, Souvenir, p. 91, **2007**.
36. "Coir pith for improvement of productivity and quality in plantation crops", Anita Das Ravindranath and U. S. Sarma, Souvenir, Placrosym XVIII, 18<sup>th</sup> Symposium on Plantation Crops, National Research Centre for Cashew, Puttur, Karnataka, 10-13<sup>th</sup> December, **2008**.
37. "Microcrystalline and nanocellulose from diseased coconut wood", Anita Das Ravindranath, Jairaj, A. P. and U. S. Sarma presented and published in the proceedings of Carbohydrate Conference held at Shimla on 12<sup>th</sup> November, **2010**.

#### PROJECT REPORTS

1. "Development of Impregnants for protective clothing (RD-P1-820DRDE – 71", by S.M. Baronia, U. S. Sarma and V. S. Tripathi submitted at Defence Research and Development Establishment [DRDE], Gwalior.
2. "Upgrading of jute fibres by means of suitable chemicals for better spinnability and production", by U. S. Sarma and R. N. Sarkar submitted at Indian Jute Industries' Research Association (IJIRA), Calcutta.

#### PATENTS GRANTED

1. A Process for the Preparation of a Fertilizer by U. S. Sarma and Anita Das Ravindranath (745/MAS/98 dated 6<sup>th</sup> April **1998**).
2. A Process for the Treatment of Coir Retting Effluents by U. S. Sarma and Anita Das Ravindranath (746/MAS/98 dated 6<sup>th</sup> April **1998**).
3. A Process for Reducing the Period of Retting of Coconut Husk using COIRRET by U. S. Sarma and Anita Das Ravindranath (747/MAS/98 dated 6<sup>th</sup> April **1998**).
4. A Process for Mechanically Extracted Green Husk Fibre by U. S. Sarma and Anita Das Ravindranath (748/MAS/98 dated 6<sup>th</sup> April **1998**).
5. A Process for Producing Paper Grade Pulp from Coir Bit Fibres (Case B )by U. S. Sarma, Anita Das Ravindranath, J.Sunil Dath and Christy Fernandez (64/MAS/99 dated 19<sup>th</sup> January **1999**).
6. A Process for Producing Paper Grade Pulp from Coir Bit Fibres (Case C) by U. S. Sarma, Anita Das Ravindranath, J.Sunil Dath and Christy Fernandez (65/MAS/99 dated 19<sup>th</sup> January, **1999**).
7. An Erosion Control Blanket (Case A) by Christy Fernandez and U. S. Sarma (588/MAS/2000 dated

28<sup>th</sup> July 2000).

8. An Erosion Control Blanket from Coir Fibres (Case F) by Christy Fernandez and U. S. Sarma(842/MAS/2000 dated 5<sup>th</sup> October **2000**).
9. An Erosion Control Blanket (Case G) by Christy Fernandez and U. S. Sarma (843/MAS/2000 dated 5<sup>th</sup> October **2000**).
10. A Readymade Lawn by Christy Fernandez, U. S. Sarma and K. P. Somanathan Nair (664/MAS/2001 dated 13<sup>th</sup> August, **2000**).
11. A process for composting of coir pith and other recalcitrant agricultural residues, T. A. Rajendra Babu, Anita Das Ravindranath, U. S. Sarma, Christy Fernandez, P. K. Ghosh (948/MAS/2002 dated 17<sup>th</sup> December, **2002**).
12. A process for preparation of coir composite board, R. Vasudev, M. Sudhakaran Pillai, U. S. Sarma, Christy Fernandez and P. G. Deshmukh (193/MAS/2003 dated 10<sup>th</sup> March, **2003**).
13. An improved mild steel handloom, T. A. Rajendra Babu and U. S. Sarma (548/CHE/2003 dated 2<sup>nd</sup> July **2003**).
14. Treatment of coconut fibres, U. S. Sarma, P.K. Ravi and A.K. Mukherjee (1177/KOL/2005 dated 23<sup>rd</sup> December, **2005**).
15. A process for dyeing of coir with natural dyes, U. S. Sarma, P.K. Ravi, I.R. Anto, V. A. Sebastian and R. Sunilkumar (1369/CHE/2003 dated 2<sup>nd</sup> July **2003**).

#### PATENTS FILED

1. Pneumatic loom for weaving mat and mattings, T. A. Rajendra Babu and U. S. Sarma (1178/KOL/2005 dated 23<sup>rd</sup> December **2005**).
2. A process for the treatment of coconut fibres after separation from husk, M. Ray, S. Ray, A. K. Mukherjee and U. S. Sarma (620/KOL/2007 dated 20<sup>th</sup> April, **2007**).
3. A mobile coir fibre extraction machine to extract fibre from green/dry coconut husk, A. Radhakrishnan, C.R. Komalakumar, T. A. Rajendra Babu and U. S. Sarma (286/Kol/2010 dated 22<sup>nd</sup> March, **2010**).
4. A fully automatic coir spinning machine to spin coir fibres into yarn, Renjith Kumar K. K., Sudheer N.S., Ajith Gopinathan Pillai, Biju C. G., A. Radhakrishnan, C. R. Komalakumar, T. A. Rajendrababu, S. Radhakrishnan, Anita Das Ravindranath, P. K. Ravi and U. S. Sarma, (502/KOL/2012 dated 7<sup>th</sup> May, **2012**).
5. Compact PVC tufting machine to produce small mats, G. Balachandran, U. S. Sarma, T. A. Rajendra Babu and Aboobacker Koya (433/Kol/2014 dated 3<sup>rd</sup> April, **2014**).
6. A process of eco-friendly softening/bleaching of coir fibres, G. Balachandran, U. S. Sarma, Anita Das Ravindranath (462/Kol/2014 dated 16<sup>th</sup> April, 2014).
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