TRANSFER OF SOME WOOD PROCESSING TECHNOLOGIES DEVELOPED BY ICFRE TO WOOD USING INDUSTRIES IN KERALA

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ABSTRACT

Upgradation of existing technologies and introduction of appropriate technologies are vital for the sustenance of wood-based industries in Kerala. A package of technologies, viz., solar kiln for drying timber, vapour phase ammonia plasticization and bending techniques for manufacture of bentwood furniture, ammonia fumigation for improving surface colour and simple techniques of preservative treatment of wood appropriate for rural areas, developed by ICFRE was transferred to the wood-using industries and other interested end-users/consumers in Kerala through this project.

A 3.5 m$^3$ capacity solar timber drying kiln was established for demonstration and popularization of low cost drying of timber. Equipments for plasticization and bending of timber were installed for the demonstration of the technique. An ammonia fumigation chamber was also got fabricated for popularizing the fumigation technique for imparting improved surface colour/shade to wood. The existing facilities at KFRI for diffusion as well as vacuum-pressure impregnation for preservative treatment of wood were demonstrated. For the purpose of disseminating the selected wood processing techniques, an information bulletin in Malayalam entitled, 'Chila thiranjedutha thadisamskarana sankethika vidyakal' ('Some selected wood processing techniques'), was prepared and published as a joint venture of KFRI and ICFRE (KFRI Information Bulletin No. 15). A Press Conference was held and the selected techniques developed by ICFRE were reported in local newspapers (English and Malayalam) and information about the training classes ('Wood Technology Clinics') and 'Open House' programmes was published in daily newspapers. A TV coverage for the transfer of the wood processing techniques was also arranged.

The details of the techniques were disseminated among the wood industries, technologists, students, end-users/consumers and other interested general public through organizing 'Wood Technology Clinics' in 13 places belonging to five different districts in the State. The audience comprised supervisory, managerial staff and workers of wood-based industries, engineers, technocrats, professional consultants, representatives of trade organizations, NGOs, end-users/consumers, students and other interested general public. The techniques were transferred through interactive lecture classes, demonstrations, slide shows, etc. Two 'Open House' programmes of 5 days duration each were conducted at KFRI, as a continuation of the technology clinics. The 'Open House' offered further opportunity to the prospective entrepreneurs and active participants of the technology clinics for getting familiarized with the installed equipments.

Industries, Trade and Consultancy Organizations, NGOs, DICs, Grama Panchayats, Universities and local colleges benefited by exposure to the selected technologies. The idea of product diversification for better profit through adoption of the available technologies was popularized and the wood-based industries in the State were benefited through this action research project supported by ICFRE.
1. INTRODUCTION

The role of wood-based industry in the economy of Kerala State is not insignificant. It offers livelihood and employment to many. The scarcity of traditional timbers and their price escalation have posed problems to the wood-based industry. Even though the State has adequate secondary timbers and timbers from non-conventional sources, adoption of the latest and appropriate processing technologies is necessary for their efficient utilization. Preservative treatment and timber drying are most important in utilization of such timbers. Proper attention with regard to these processing techniques will not only help in achieving better value-addition to products, but also in bringing better prospects. Product diversification is yet another option for reorienting sick units. For all these, appropriate processing techniques need to be transferred to the wood-using industries. Upgradation and renovation of existing technologies and introduction of new technologies are vital for the sustenance of wood industries in the State. As ICFRE has a package of technologies ready for transfer to wood industry, an action project on 'Transfer of some wood processing technologies developed by ICFRE to wood using industries in Kerala' was proposed.

The main objective of the project was to transfer the techniques to wood-using industries in Kerala for setting up solar kiln for timber drying, plasticization and bending of wood, ammonia fumigation of wood for improved surface colouring and preservative treatment of secondary timbers by basic facilities in the Kerala Forest Research Institute for demonstration. 'Wood Technology Clinics', follow up action through 'Open House' programmes and circulation of promotional literature (Information Bulletin) were planned as major activities of this project to assist the sustenance of the existing wood-based industries as well as the prospective entrepreneurs.

A brief account of the technologies standardized by ICFRE and their relevance to the wood industries in Kerala is given below.

1.1 Solar drying of timber

For ensuring the quality as well as service performance, it is very essential to adopt appropriate drying techniques while processing the wood. Although the cost for air-drying timber is lower, it has disadvantages like longer time requirement and uncontrolled drying leading to serious defects and the consequent wastage. Also the possibility of bio-degradation due to the attack by bacteria, fungi, insect borers, termites, etc. is an inherent part of the air drying system, leading to severe loss especially in the case of perishable timbers. While the conventional kiln drying can lower the drying time considerably, it is more expensive. But control over the drying process is possible in this system. Requirements of skilled manpower and the high initial investment make kiln drying unpopular among small scale wood industries in Kerala.

Drying is one of the important stage in processing rubber wood, a major source of timber in Kerala. As preservative treatment has an integral part of any rubber wood based industry, the treated timber has to be dried
before it could be processed. Kerala has about 30 rubber wood processing units. Hence timber drying is very important in the Kerala scenario.

Even though Kerala lies between 8° and 15° N longitude, with monsoon rains and frequent cloud cover, it is estimated that there are about 2500 hours of sunshine per year with very little seasonal variation. This shows the potential for setting up solar kilns in Kerala. A glass house type FRI model solar kiln can be effectively utilized for reducing the energy requirements for drying timber.

1.2 Wood plasticization and bending techniques

Product diversification to maximize profit can be effected through adoption of novel techniques. Use of bentwood wood in furniture, housing, sports goods, boats, ships and in several other decorative and utility items is much popular. Shaping solid wood into curved components is uneconomical from the point of view of material requirement. Even though steam bending has been used, it has limitations with regard to the minimum radius of the bend, requirement of boiler, etc.

Bending wood after plasticizing it with vapour ammonia is an economical substitute process from the product diversification view point. Ammonia with its hydrogen bonding efficiency, acts as a weak solvent on the constituents of wood and enables the wood to swell and soften. The ammonia plasticized wood can be bent to desired shape by applying end-pressure.

As rubber plantations have become a major source of timber in Kerala, secondary processing of rubber wood is essential to add value to the product. Bending is one operation, which would make the timber suitable for different components of furniture.

1.3 Ammonia fumigation and colouring of wood

For furniture and other decorative items, surface appearance of timber is of great importance. Improving surface appearance/colour of some secondary species may fetch higher prices and to achieve this ammonia fumigation can be employed as an economical method. The tannin in wood reacts with ammonia vapour forming tannates, which are rich reddish/yellowish brown in colour. Exposing the finished articles (before the application of polish) to ammonia fumes from liquor ammonia is effective in bringing out the characteristic hue and prominent surface figure in tannin rich woods (e.g. eucalypts, acacia, teak, *Dalbergia sissoo*, etc.). For timbers that are not rich in tannin (e.g. lighter woods and plain looking timbers like poplars, rubber wood, mango, etc. and sapwood of many species), a modified treatment in which fumed articles are swabbed or dipped in bark extracts/tannin solution is recommended. The shade of the surface colour of the fumed articles can be varied by controlling the fumigation intensity. The essential requirement for the process of fumigation is only an air-tight fumigation chamber of appropriate size that can accommodate the articles for fumigation and trays for keeping liquor ammonia.
Preservative treatment

Timbers, which are non-durable, require treatment with preservative chemicals to increase their service life. Many secondary species and non-conventional timbers such as rubber wood, coconut wood, bamboos, etc. are generally non-durable. Thus, the use of preservative treatment, particularly use of effective chemicals and simple methods of treatment need to be popularized. Also, different aspects of preservative treatment need to be disseminated among wood-based industries. The finer details of the treatment such as choosing the right concentration of treatment solutions, maintaining dry salt retention (DSR) specifications, effect of the nature of chemicals on end-use, etc. need to be conveyed. Besides, there is a strong need for creating awareness among the wood users.

ACTIVITIES

2.1 Initiation of the project

The project activities started with the visit of Dr. C.N. Pandey from FRI who is an expert in solar timber drying technology. The site for solar kiln was selected during his visit in September 1998. Dr. Pandey provided the plan and drawings for the construction of the kiln. The capacity of the kiln was brought down to half as that proposed the original plan (present capacity 3.5 m$^3$). It was felt that the 3.5 m$^3$ capacity would be ideal for demonstration purpose and this size was more appropriate to the site selected. Considering local conditions, instead of teak, preservative treated rubber wood was selected for the framework of the kiln; it was felt that this would help to popularize the use of treated rubber wood for exterior applications. Also this would provide opportunity to assess the performance of Copper-Chrome-Arsenate (CCA) treated rubber wood in outdoor structural applications.

One Technical Officer (Mr. P.K. Thulasidas) from the Wood Science Division of KFRI underwent training at FRI, Dehra Dun for a period of two weeks during October 1998. He got trained in the solar drying of timber and wood plasticization and bending technology.

The required equipments and accessories (the fan and humidifier of solar kiln; ammonia plasticization equipment) were procured from a FRI - approved manufacturer in Haryana. Some components were fabricated locally (see appendix 1).

2.2 Implementation

2.2.1 Solar kiln for timber drying

A model solar timber drying kiln with a minimum capacity of 3.5 m$^3$ has been installed at the Kerala Forest Research Institute, Peechi, (Fig. 1 & 2) for demonstration and popularization.
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**Site and layout**

The site was selected in such a way that no shadow of any nearby tree or building would cast on the kiln. The kiln was installed on a 4 m x 3 m concrete platform raised nearly 150 mm above the surrounding ground level. The long axis of the kiln was oriented in east-west direction and the slope of the roof inclined towards the south.

**Design and structure**

CCA treated (to a loading of 12 kg/m$^3$) and kiln dried rubber wood was utilized for the framework of the kiln. Glass sheets were procured locally. The fabrication and installation work of the kiln was entrusted to a local rubberwood-based industrial unit. This step helped in giving an on-line training to the industrial unit in manufacturing solar timber drying kiln.

The angle of the roof was calculated as 0.9 times the latitude. (At Peechi, the angle of tilt is $9.27^\circ$, as the latitude is $10.3^\circ$ N). The kiln roof was tilted towards the south by adjusting the height of the north wall but keeping the height of the south wall fixed at 2.3 m. The external dimensions of the kiln were 3.7 m (L) x 2.9 m (W) x 2.3 m (H) at south wall and 3.0 m (H) at the north wall. The charging capacity was around 3.5 m$^3$.

**Modifications made**

The fan was not directly attached to the motor; instead it was attached to a shaft by means of a pedestal with pulley and belt. The leaf size of the fan was large and shaft of the motor was protruding out of the kiln wall. The shaft length was reduced to accommodate the same inside the kiln wall plenum gap.

**Improvements suggested**

As fans that can be directly attached to the motor are available, the fan assembly can be improved further. Also, the present fan leaves are heavy as they are large in size. Fans used in steam kilns can be made use of.

The possibility of incorporating a dehumidifier in the system may be considered in future. This will help in further reducing the drying time. Also, the possibility of utilizing solar cells to generate electricity for running the fans and/even for generating heat for drying the timber during night time can also be thought of in future.

**2.2.2 Ammonia plasticization for bent wood**

The vapor ammonia plasticization equipment consists of a 1500 mm x 150 mm cylinder of 10 mm thickness, made of mild steel, and provided with two inlets and one outlet, with stainless steel valves and a pressure-cum-vacuum gauge (Figs. 3 and 4). One of the inlets is connected to a vacuum pump and the other to a commercial ammonia gas cylinder through a pressure-regulating valve. The outlet provided at the bottom of the
cylinder is connected to water reservoir by hose for absorbing remnant ammonia gas discharged from the
cylinder after the treatment.

**Trial with rubber wood**

It was found that rubber wood strips of 13-25 mm thickness at a moisture content of 22-18% can be
satisfactorily bent to a range of radii covering 100-37 mm by ammonia plasticization and various curved wood
furniture/articles can be produced (Fig. 7). Moulds, flexible metal straps and L clamps used in bending the
wood strips are shown in figures 5 and 6.

**Improvements suggested**

The manufacturing defects of the present system, its control valves, etc. lead to frequent leakage of gas which
makes the system user un-friendly. Future work should be concentrated on making the system more convenient
and user friendly. The used ammonia gas is wasted in the present system. An appropriate system should be
developed in future for the effective recycling of the ammonia gas.

2.2.3 Ammonia fumigation for improved surface colouuration

In this technique, unpolished end-products like tables, chairs, door and window panels, turnery articles,
handicraft items, etc. are exposed to ammonia vapour at room temperature in the air-tight fumigation chamber
(Fig. 8) for a period of 12-48 hours, or even more depending on the depth of shade desired.

The fumigation chamber (fabricated locally, made with plywood and treated rubber wood) made for the work
had a dimension of 1.2 m x 1.85 m x 1.05 m, capable of holding real sizes of furniture for fumigation. The
chamber contained a wooden platform with holes of 50 mm x 50 mm below which liquor ammonia could be
placed in plastic trays. The door was provided with a glass panel for viewing the colour changes.

*Eucalyptus tereticornis* woodwork which was subjected to fumigation developed the figure and surface
appearance comparable to walnut. After polishing, this fumed material was found to attain an antique look (Fig.
9). In the case of silver oak, fumigation for 2 hours imparted a violet colour to the wood in 25 mm thick cross
sections.

**Suggestions for improvement**

The present system does not allow recycling of the remnant ammonia vapour generated from liquor ammonia.
Further research efforts need to be concentrated on this aspect. Also, one has to look for safe removal/disposal
of ammonia fumes from the chamber as the present system lets out the vapour to atmosphere. Also, the
possibility of combining the ammonia plasticization unit with fumigation unit needs to be looked into, as both
the treatments use ammonia. The spent vapour ammonia from the plasticizing unit can be considered as a source of ammonia for fumigation treatment.

2.2.4 Preservative treatment of timber

Even though it was originally proposed to popularize ammoniacal copper arsenite (ACA) preservative developed at ICFRE, this could not be done due to the non-availability of arsenic trioxide. Efforts made to procure this chemical were not successful. Further, the arsenite being highly toxic, we thought that environmental issues might arise concerning the disposal of toxic waste solution. All these factors prevented introduction of ACA for the treatment of coconut wood, bamboos, etc., which are widely used by the rural people. Instead, it was decided to create scientific awareness on the need for the use of treated timber, dry salt retention (DSR) recommendations, the right of consumers, etc. among the general public as well as wood-based industries. As rubber wood is the cheapest wood available in the State, more emphasis was given to propagate the need for proper protection of the timber. This was done through 'Wood Technology Clinics' and 'Open House' programmes. Outdoor furniture was made from treated rubber wood for demonstration purpose (Fig. 10).

2.3 Promotional literature and publicity

For the purpose of disseminating the wood processing techniques developed by ICFRE to wood-using industries in Kerala, an information bulletin in Malayalam ('Chila thiranjedutha hadisamkarana sankethika vidyakal' - 'Some Selected Wood Processing Techniques'. KFRI Information Bulletin No. 15, 30p.) was prepared and 1000 copies printed, published jointly by KFRI and ICFRE, and circulated among the end-users, and participants of training classes ('Wood Technology Clinics') and 'Open House' programmes.

A Press Conference was held on 13 September 1999 and the selected wood processing techniques developed by ICFRE, ready for transfer to wood-using industries in Kerala through KFRI, were reported in the local (Malayalam and English) newspapers. Information about 'Wood Technology Clinics' and 'Open House' programmes were reported to the Press and news published in popular newspapers (see enclosed paper cuttings). The promotional literature was released in the Press Conference. A TV coverage by Surya channel was made possible on 18 September 1999 at 7 p.m. in the 'News'.

2.4 Training-cum-awareness classes

2.4.1 Wood Technology Clinics

Even though it was proposed to cover six Panchayats from six Districts for conducting training-cum-awareness classes, it was possible to cover only five Districts. But these Districts were selected in such a way as to cover the main places of predominance of wood industries in the State. Instead of six Panchayats, nine Panchayats were covered (Peechi, Ayyanthole, Chettuva, Nattika, and Ollur from Thrissur District, Perumbavoor and
Aluva from Emmakulam District, two places in Kottayam city, Mundoor from Palakkad District and Nilambur from Malappuram District. Extension classes were conducted under the banner, *Wood Technology Clinics - Sponsored by ICFRE & KFRI*. Totally thirteen technology clinics were conducted in collaboration with Universities, NGOs, Industries and Trade Organizations, DICs, Grama Panchayats, Consultancy Organizations and Local Colleges (Fig. 11 and Appendix 2). A total of around 400 persons participated in these technology clinics arranged at different places (appendix 3).

The classes for the 'Wood Technology Clinics' consisted of lectures on

(1) Solar timber drying kiln

Importance of using dried timber - Principles of timber drying - drying with reduced defects - advantages of solar drying over air/kiln drying - solar timber drying kiln - design and structure, operation, schedules, etc.

(2) Vapour phase ammonia plasticization technique for the manufacture of bentwood furniture

Theory of wood plasticization - steam plasticization Vs ammonia plasticization - advantages and disadvantages - equipment for vapor ammonia plasticization, its operation, hand bending techniques - use of clamps and flexible metal straps, wooden moulds, curing bent items - care and safety while using ammonia - bentwood furniture.

(3) Ammonia fumigation

Ammonia fumigation for improved surface colour - theory, effect of tannin content, species, density, thickness of sizes, exposure duration and intensity of shade/colour - examples and applications.

(4) Preservative treatment of wood for improved durability.

Theory - natural durability, need for protection - biodeterioration - bacteria, fungi, insects/borers, termites, marine borers, weathering - application of preservative chemicals and methods of treatment, Indian and International standards, Dry salt retention (DSR) recommendations, quality checks, consumer rights, etc.

The 'Wood Technology Clinics' generated much interest among entrepreneurs. All the above mentioned agencies (Appendix 2) were actively involved in the planning and implementation of the project. The wood-based industries were benefited by getting exposure to the ICFRE technologies.

### 2.4.2 Open House programmes

*Open House* programmes were conducted at KFRI, Peechi as a continuation of the Technology Clinics. Prospective entrepreneurs and the active participants of the technology clinics were given further opportunity to
familiarize with the installed equipments and facilities at KFRI. The equipments and techniques were demonstrated to the participants (Fig. 11).

Even though 'Open House' of one week duration was proposed thrice a year during the second year of the programme, the delay in getting equipments from Haryana caused delay in commissioning the facilities. Due to this; it was possible to conduct only one 'Open House' of 5 days duration during the month of September 1999 (Appendix 1).

However 'Open House' for 5 days during 17-21 July 2000, was conducted in connection with the Silver Jubilee Celebrations of KFRI. A total of about 1000 persons visited the Institute during the week. Opportunity was extended to interested individuals to visit and familiarize the installed equipments and facilities.

3. CONCLUSION

The installation, and demonstration of the equipments and facilities created opportunity to local wood-based industries to familiarize and consequent themselves with modern technology, attempt to manufacture similar products connected with wood-processing. The industrial unit which undertook the installation work of the solar timber drying kiln is now capable of manufacturing similar kilns. The industrial unit which undertook the rectification work of the wood plasticization plant is now familiar with the use of ammonia and its consequences in wood plasticization. A furniture manufacturing unit has shown considerable enthusiasm in producing bentwood furniture from ammonia plasticized wood. Many rubber wood based industries are now convinced about wood preservation techniques and the quality of treated wood. They have been trained in the use of appropriate concentration of treatment solutions required to achieve desired dry salt retention (DSR) levels in the treated wood, different treatment methods, schedules and chemicals, the interaction of various parameters such as moisture content of wood at the time of treatment, thickness of wood, impregnation schedule and desired DSR levels. Also, they have been exposed to the drying of timber using solar kiln, steps to be taken while drying timber in order to reduce defects and rejects, installation and fabrication of solar kiln, etc. Apart from these, the Wood Technology Clinics and Open House Programmes benefited many existing industries, prospective entrepreneurs and students. The possibility of product diversification was appreciated by the existing wood based industries (see appendix 4 for the list of beneficiaries). The information bulletin published served as a valuable hand book for the local industries. The installed equipments and facilities at KFRI have created an opportunity for the public to be convinced of the scope of wood processing techniques. Also, this has opened up an avenue for further work in the same field (for example, STEC, Kerala, has granted fund for a scheme intended for extending the transfer of wood processing technologies to wood using industries in some other districts in the State, not covered under this project). Future efforts will be concentrated on the improvement and appropriate modification of the equipments and facilities for economizing the system.
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## Appendix 1

### Agencies approached for equipments, installation, fabrication and rectification works

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<tr>
<th>Sl. No</th>
<th>Agency</th>
<th>Description</th>
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| 1 | Kartar Engineering Works  
16, Industrial Estate, Yamuna Nagar 135 001  
N.P. Jagadhri, Haryana. | 1. Fan and motor assembly for the Solar Kiln  
2. Wood plasticization plant |
| 2 | C. Doctor & Co. Pvt. Ltd.  
10, Cowley Brown Road, RS. Puram,  
Coimbatore. 641 002,  
TamilNadu | 'Doctaire' brand humidifier for solar kiln |
| 3 | Shivam Rubber  
Mohna Road  
Ballabgarh 121 004 | Rubber beadings for the wooden frame work of solar kiln |
| 4 | Wood Tech Industries  
294/1X, Pullur P.O.  
Kallettumkara, Thrissur 680 683, Kerala | Fabrication and installation of solar kiln |
| 5 | Geo Refrigerations  
VII/403, East Surya Gram  
Thrissur, Kerala 680 005 | Rectification works of the ammonia plasticization plant |
Appendix 2

List of Wood Technology Clinics and Open House Programmes

Wood Technology Clinics

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Agency and address</th>
<th>Date</th>
<th>No. of Participants</th>
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<tr>
<td>1</td>
<td>Kerala Forest Research Institute, Peechi. P.O, Thrissur Dt. Kerala (for the students of Natural Rubber Production, College of Horticulture, Kerala Agricultural University (KAU), Mannothy, Thrissur Dt., Kerala)</td>
<td>18-08-1999</td>
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<td>Center of Science and Technology for Rural Development (COSTFORD), Ayyanthole P.O, Thrissur Dt., Kerala</td>
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<td>10</td>
<td>Indian Rubber Wood Task Force, Kottayam, Kerala</td>
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<tr>
<td>11</td>
<td>St. Thomas' College, Thrissur, Kerala (for Botany students)</td>
<td>09-11-1999</td>
<td>50</td>
</tr>
<tr>
<td>12</td>
<td>Sree Narayana College, Nattika, Thrissur, Kerala (for Botany students)</td>
<td>14-11-1999</td>
<td>50</td>
</tr>
<tr>
<td>13</td>
<td>Integrated Rural Technology Centre (IRTC), Mundoor P.O, Palakkad Dt., Kerala</td>
<td>19-11-1999</td>
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</tr>
</tbody>
</table>

Open House Programmes

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Place</th>
<th>Date</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wood Science Division, KFRI, Peechi (1) 1999 July 17-21 680 653, Kerala, India (2) 1999 September 16,18,20,27,28</td>
<td>17</td>
<td>around 1000</td>
</tr>
</tbody>
</table>
## Appendix 3

**List of participants in various Wood Technology Clinics and Open House Programmes**

<table>
<thead>
<tr>
<th>No</th>
<th>Name &amp; Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Wood Technology Clinic held at KFRI, Peechi</strong></td>
</tr>
<tr>
<td></td>
<td>17 students of Natural Rubber Production at the College of Horticulture, Kerala Agricultural University (KAU), Mannuthy, Thrissur Dt., Kerala. <em>Names and addresses not recorded.</em></td>
</tr>
<tr>
<td>2.</td>
<td><strong>Wood Technology Clinic held at COSTFORD, Ayyanthole, Thrissur Dt., Kerala</strong></td>
</tr>
</tbody>
</table>
|     | **Anto Peter**  
|     | COSTFORD  
|     | Ayyanthole, Thrissur  
|     | **Antony. C.K.**  
|     | Cheuvathoor House  
|     | Vengidangu, Thrissur |
|     | **Antu. K.V.**  
|     | Parackal Kuttikkat House  
|     | Velur, Thrissur  
|     | **Fransis B.D.**  
|     | Ayyanthole, Thrissur |
|     | **Jayasree P.S.**  
|     | COSTFORD  
|     | Ayyanthole, Thrissur  
|     | **Joshy Jacob**  
|     | Excel Wood Crafts  
|     | Ollur, Thrissur |
|     | **Joy. C.C.**  
|     | Chirangathu House  
|     | Mullassery, Thrissur  
|     | **K.A. Najmul Hussain**  
|     | Executive Engineer  
|     | COSTFORD, Ayyanthole, Thrissur |
|     | **K.A. Seethi**  
|     | Lecture in Mech. Eng.  
|     | Govt. Eng. College, Thrissur  
|     | **K.K. Sajan**  
|     | 'Karumal'  
|     | Velur, Thrissur |
|     | **K.R. Unnicheckan**  
|     | Kottekadu House  
|     | Thykkattusery, Thrissur  
|     | **M.J. Anto**  
|     | Manjaly House  
<p>|     | Varamthirappaly, Thrissur |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Mili. J.</td>
<td>'Aswathi' Veliyannur, Thrissur</td>
<td></td>
</tr>
<tr>
<td>P.K. Suresh</td>
<td>Panoly House Vadakkummury, Peringottukara, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Paulson E.K.</td>
<td>Varium Road Thrissur</td>
<td></td>
</tr>
<tr>
<td>Ramesh</td>
<td>Mega Associates Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sabitha P.K.</td>
<td>COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sajan P.S.</td>
<td>Swaraj Furniture Mambra, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sajitha K.M.</td>
<td>COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Shaji Baby</td>
<td>'Deepthi', Near Ulloor Bridge Pattam, Trivandrum</td>
<td></td>
</tr>
<tr>
<td>Sindhu. R.A.</td>
<td>Erattu House Mathilakam P.O., Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sree Kumar</td>
<td>COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>P.K. Chacko</td>
<td>Mega Associates Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>P.P. Rajiv</td>
<td>COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Preethi. M.K.</td>
<td>'Sreeragam' Chettupuzha, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Reshmi. C.</td>
<td>'Kalyani Nilayam' Puthurkara, Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sahana P.A.</td>
<td>Puthiyaveetil House, Kaithakkal Thalikulam P.O., Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sajith. C.R.</td>
<td>Cheruvallil House Thandankulam Kodugallur, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Saritha P.B.</td>
<td>Site Engineer, COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sidharthan M.A.</td>
<td>Modangath House Pazhanji P.O., Thrissur</td>
<td></td>
</tr>
<tr>
<td>Sindhu.T.V.</td>
<td>Thumbayil House Avinissery, Thrissur</td>
<td></td>
</tr>
<tr>
<td>T.R. Chandra Datt</td>
<td>Director COSTFORD Ayyanhole, Thrissur</td>
<td></td>
</tr>
</tbody>
</table>
3. Wood Technology Clinic held at Nirmithi Kendra, Chettuva, Thrissur Dt, Kerala

Ajith T.A.
Site Engineer
Nirmithi Kendra, Ayyanthole
Thrissur

A.P. Prav ven Prasad
Nirmithi Kendra, Ayyanthole
Thrissur

A.T. Asharaf
Karayil House
Orumanayoor, Thrissur

A.V. Satheesan
Arayangattil House
Koorikuzhi, Thrissur

Babitha T.V.
Supervisor
Nirmithi Kendra, Ayyanthole, Thrissur

Biju Joseph M
Nirmithi Kendra, Ayyanthole
Thrissur

Aneesh C.K.
Supervisor
Nirmithi Kendra, Ayyanthole, Thrissur

A.S. Lakshmanan
Aerathu House
P.O. Perinjanarn West, Thrissur

A.T. Ibrahimkutty
'Thoomat'
P.O. Orumanayoor, Thrissur

Anitha Fransis
Asso. Project Engineer
Nirmithi Kendra, Ayyanthole, Thrissur

Beena M
Supervisor
Nirmithi Kendra, Ayyanthole, Thrissur

Binny A.P.
Arackal House
Thalikulam, Thrissur
Bishon A.P.
Arackal House
Thalikulam, Thrissur

C.A. Sivaraman
Chakkanda House
Orumanayoor P.O., Thrissur

Chandran P.A.
Nirmithi Kendra, Ayyanhole
Thrissur

E.J. Pradeep
Eravanezhath
P.O. Thalikualm, Thrissur

Fiju K.F.
Supervisor
Nirmithi Kendra, Ayyanhole, Thrissur

Gogin M.
Supervisor
Nirmithi Kendra, Ayyanhole, Thrissur

Jancy P. Jena
Supervisor
Nirmithi Kendra, Ayyanhole, Thrissur

Jenson M.V
New Timber Land
Kuttanallur, Thrissur

K.K. Bukhari
Popular Wood Industries
Peringottukara, Thrissur

Lathish Kumar
Nirmithi Kendra, Ayyanhole
Thrissur

C. Muhammad Sherif
Kadikkallayil Saw Mill
Attupuram, Thrissur

Chandran Edakkali
Capital Wood Land
Manikandeswaram, Thrissur

Dhana M
Supervisor
Nirmithi Kendra, Ayyanhole, Thrissur

E.V. Manoharan
Eduvayil House
Enganidiyoor, Thrissur

Geethambiks N.
Site engineer
Nirmithi Kendra, Ayyanhole, Thrissur

James P.L.
Pulikkottil House
Koonammooch, Thrissur

Jayachandran T.K.
Therayil House
Kazhibrum, Thrissur

K. Suresh
Kuruppath House
Koalzhi, Thrissur

K.V. Venugopalan
Devasilpi Wood Works
Kaipamangalam, Thrissur

M.J. Thomas
Mattath House
P.O. Kottapadi, Thrissur
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.V. Mruthyunjayan</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
<td>Madakkal House, Kaipamangalam, Thrissur</td>
</tr>
<tr>
<td>Manaf C.K.</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
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<tr>
<td>Mythili I.S.</td>
<td>Engineer, Nirmithi Kendra</td>
<td>Ayyanthole, Thrissur</td>
</tr>
<tr>
<td>Navas. P.U.</td>
<td>Puthen veedu</td>
<td>Nettissery, Thrissur</td>
</tr>
<tr>
<td>Nishanth A.K.</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
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<tr>
<td>P.G. Sudheer</td>
<td>Thalikulam,</td>
<td>Thrissur</td>
</tr>
<tr>
<td>P.S. Chandran</td>
<td>Thejus Wood Industries</td>
<td>Kunnamkulam, Thrissur</td>
</tr>
<tr>
<td>Praveen K.K.</td>
<td>Nirmithi Kendra, Ayyanthole</td>
<td>Thrissur</td>
</tr>
<tr>
<td>Sajitha A.S.</td>
<td>Nirmithi Kendra, Ayyanthole</td>
<td>Thrissur</td>
</tr>
<tr>
<td>Saliny K.K</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
</tr>
<tr>
<td>Madhu P.N.</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
</tr>
<tr>
<td>Manju K. Manoharan</td>
<td>Nirmithi Kendra, Ayyanthole</td>
<td>Thrissur</td>
</tr>
<tr>
<td>N.S. Arun</td>
<td>Neelima Timber Industries</td>
<td>Kundaliyoor, Thrissur</td>
</tr>
<tr>
<td>Nazer A.T.</td>
<td>Thomat House</td>
<td>Orumayoor, Thrissur</td>
</tr>
<tr>
<td>O.L. Joseph</td>
<td>Olakkayal House</td>
<td>Kottapadi, Thrissur</td>
</tr>
<tr>
<td>P.R. Sindhu</td>
<td>Technical Assistant</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
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<tr>
<td>Prasannan K</td>
<td>Karayil House</td>
<td>Guruvayoor, Thrissur</td>
</tr>
<tr>
<td>Rajeev K.B.</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
</tr>
<tr>
<td>Salim K.J.</td>
<td>Supervisor</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
</tr>
<tr>
<td>Sandhya K.G.</td>
<td>Supervisor,</td>
<td>Nirmithi Kendra, Ayyanthole, Thrissur</td>
</tr>
</tbody>
</table>
Saritha Sebastian  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Shaiju Antony  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Shaji K.J.  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Shameer. R.H.  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Siji Jose  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Sreejith T.G.  
Nirmithi Kendra, Ayyanthole  
Thrissur

Subhash A.V.  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Sumesh N.N.  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Thilakan P.K.  
'Wood House'  
Beech Road, Vadanampally, Thrissur

V.R. Sasikumar  
Vallath House  
Thalikulam, Thrissur

Sebastian N.G.  
Nirmithi Kendra, Ayyanthole  
Thrissur

Shaji C.G.  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Shaju. T.M.  
'S' Nivas  
P.O. Velupadam, Thrissur

Shibi K.R  
Supervisor 
Nirmithi Kendra, Ayyanthole, Thrissur

Sindhu R.  
Site Engineer  
Nirmithi Kendra, Ayyanthole, Thrissur

Sreejith Varma  
Supervisor  
Nirmithi Kendra, Ayyanthole, Thrissur

Sumesh E.R.  
Site Engineer  
Nirmithi Kendra, Ayyanthole, Thrissur

T.L. Jaison  
Tharakan House  
Koonammuchi, Thrissur

Titus Paul, Managing Director  
Chirrammel Associates  
Thrissur
4. **District Industries Centre (DIC), Ayyanthole P.O, Thrissur Dt., Kerala**
   - **A.A. Wilson**
     - Orient Timber Industries
     - P.O. Thalore, Thrissur
   - **Francis M. Alaphatt**
     - Raja & Co, Poduval Road
     - Ollur, Thrissur
   - **Jex Joy**
     - Muthipeedika House
     - Avaniseery, Ollur, Thrissur
   - **Joshy Kokkal**
     - Holy Angels Road
     - Ollur, Thrissur
   - **K.K. Paul**
     - Kathukara House
     - Ollur, Thrissur
   - **M.S. Sajeesh**
     - Sreedhar Wood Industries
     - P.O. Thaikkatuseery, Ollur, Thrissur
   - **P.D. Seby**
     - Payyappilly House
     - Chalakkudy, Thrissur
   - **P.K. Padmaanbhan**
     - Panikkaveetil House
     - Pallisery, Thrissur
   - **P.P. Paul**
     - Pullan House
     - Chalakkudy, Thrissur
   - **C.S. Ramaswamy**
     - Soumya Industries, Kurumassery
     - Irinjalakuda, Thrissur
   - **I.O. Antony**
     - 'Iyyal Bhavan'
     - P.O. Avinissery, Thrissur
   - **Johnson Muttath**
     - J.K.M. Wood Industries
     - Karuvankad, Kundukad P.O., Thrissur
   - **Joy M.J.**
     - Muthipeedika House
     - Avaniserry, Ollur, Thrissur
   - **M.K.K. Nambiar**
     - Pushpakath House
     - Kakkayur P.O., Palakkad
   - **P. Rajagopal**
     - Vijaya Nagar
     - Ayyanthol, Thrissur
   - **P.K. Chandran**
     - Rajendra Wood Industries
     - P.O. Avinissery, Thrissur
   - **P.K. Ramachandran**
     - Peechampilly House
     - Koovapady, Perumbavoor, Emakulam
   - **T.A. David**
     - Thoppil House
     - Poothol, Thrissur
5. Wood Technology Clinic held at FIT, Aluva, Eranakulam Dt, Kerala
Names and addresses of participants not recorded.

6. Wood Technology Clinic held at Ollur Grama Panchayath, Ollur P.O, Thrissur Dt, Kerala

Ammini S. Madhavan
Mannakkatt House, Ollur
Thrissur

Anto Paul Katukkaran
Poduval Road, Ollur, Thrissur

C.K. Sushand
Chiraparambath House
Thalavanikkara, Thalore P.O., Thrissur

C.V. Sreeinivasen
K.W.A. Operator, Ollur, Thrissur

Jimmy Jos
Ollur, Thrissur

K.G. Radhakrishnan
Kuttichira House
Anchery P.O., Thrissur

K.K. Rophal
Ollur, Thrissur

K.K. Kuttan
Kottekkattil House
Anchery P.O., Thrissur

K.P. George
Saw Mill, Kuttanallur, P.O
Thrissur

M.M. Gopala Krishna Panikker
Ollur, Thrissur

Anandan
Vazapilly House
Anchery, Thrissur
Antony Erukkaran
Panchayathu member, Ollur, Thrissur
C.M. Ramachandran
Cheruvathery House
Thaikkatusery P.O., Thrissur
George Immetty
Retd. Head master
Ollur, Thrissur
K.A. Krishnan
Panchayathu member, Ollur, Thrissur
K.G. Sivadasan
Kuttichira House
Anchary P.O., Thrissur
K.K. Kochappan
Panchayath member, Ollur, Thrissur
K.M. Sreedharan
Kombaruparambil House
Anchery P.O., Thrissur
Kamalam Purushothman
Panchayathu member, Ollur
Thrissur
M.V. Pushparaj
Makkalikkal House
Anjur P.O., Kizhoor, Thrissur
<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prathap Kumar</td>
<td>L.D.C. Panchayath Office, Ollur, Thrissur</td>
</tr>
<tr>
<td>P.S. Sathesan</td>
<td>Paraparambil House, Ollur P.O. Thrissur</td>
</tr>
<tr>
<td>Sunny Kattukaran</td>
<td>Cousin Corporation, Ollur, Thrissur</td>
</tr>
<tr>
<td>T.K. Sadanandan</td>
<td>Thachampilly House</td>
</tr>
<tr>
<td>V.K. Sreedharan</td>
<td>J.S., Ollur Panchayath Office, Ollur, Thrissur</td>
</tr>
<tr>
<td>P.G. Balan</td>
<td>Ollur, Thrissur</td>
</tr>
<tr>
<td>Shaji Mannappetty</td>
<td>Mannappetty House</td>
</tr>
<tr>
<td>T.J. Francis</td>
<td>T.J. Enterprises</td>
</tr>
<tr>
<td>T.K. Sasidharan</td>
<td>Thekkoote House, Anchery P.O., Thrissur</td>
</tr>
<tr>
<td>V.K. Sreedharan</td>
<td>J.S., Ollur Panchayath Office, Ollur, Thrissur</td>
</tr>
<tr>
<td>Saw Mills Owner's Association (SMOA), Perumbavoor P.O., Ernakulam Dt., Kerala</td>
<td></td>
</tr>
<tr>
<td>Alexander Philip</td>
<td>Ashref Wood Industries</td>
</tr>
<tr>
<td>Philip Son Saw Mill &amp; Industries</td>
<td>Pallippuram, Mudikkal Perumbavoor, Ernakulam</td>
</tr>
<tr>
<td>B. Vinod</td>
<td>Babu Paul</td>
</tr>
<tr>
<td>'Ushus', Edayaparam</td>
<td>Paruthuvayalil House</td>
</tr>
<tr>
<td>Alwaye, Emakulam</td>
<td>Keezhillam, Ernakulam</td>
</tr>
<tr>
<td>Basheer N.S.</td>
<td>Eldho M.P.</td>
</tr>
<tr>
<td>Naanethean House</td>
<td>Elson consultants &amp; adverts</td>
</tr>
<tr>
<td>Allapara P.O., Perumbavoor, Ernakulam</td>
<td>Valayanchirangara P.O. Perumbavoor, Ernakulam</td>
</tr>
<tr>
<td>Hamsa K.A.</td>
<td>Jegith Thampi</td>
</tr>
<tr>
<td>Kottayil House</td>
<td>Perfect Saw Mill Allapra P.O.</td>
</tr>
<tr>
<td>Rayon Puram, Perumbavoor, Emakulam</td>
<td>Perumbavoor, Ernakulam</td>
</tr>
<tr>
<td>K. Varghees</td>
<td>K.A. Aboobacker</td>
</tr>
<tr>
<td>Kizhakkumparambil Wood Industries</td>
<td>Kanampuram Saw Mill Vattakattupady, Perumbavoor</td>
</tr>
</tbody>
</table>
K.A. Ali
Jas Plywoods
Vattakattupady, Perumbavoor

K.K. Ebrahim
Presswood Industries
Vengola, Perumbavoor, Ernakulam

K.P. Jili
Kalamassery, M.M. Road
Ernakulam

M.M. MugeebRahaman
Kiln Veneers, KSRTC Road
Perumbavoor, Ernakulam

P.R. Plywoods (Rep)
Okkal P.O.
Perumbavoor, Ernakulam

Moncy Joseph
Peeinjardthu House
South Marady, Muvattupuzha

P.K. Dharmapalan
Puthuparambil House
Kottayam

Rahim
K.K. Veneers
Vattakattupady, Perumbavoor, Ernakulam

T.K. Vijayan
Thandayathukudy House
Eralmalloor P.O., Kothamangalam, Ernakulam

K.K. Abdulla
Karuthukudy House
Kandantra, Allapara P.O., Perumbavoor

K.K. Kesavan
Kunnamveetttil House
Palluruthy, Kochi 6

K.V. Poulse
Asian Veneers
Chelakulam, Vengoar, Perumbavoor

M.S. Aliyar
MScientist-in-charge Plywoods Vembilly
Kumarapuram, Ernakulam

Moideen C.V.
CV M Woods
Keenpuram Industrial Estate, Ernakulam

P. Narayana Pillai
Parathu Madam
Uliyannoor
Alwaye, Ernakualm

Paulose John
Paulson Wood Industries
Kuruppampady P.O., Pemmbavoor

Sunny T.T.
Thombrakudiyl House
Kombanad P.O., Ernakulam

Tipson
T.P. Mariikkar Kunnji
A.M. Road, Perumbavoor, Ernakulam
<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U. Ummar</strong></td>
<td>Fathirna Timber Industries</td>
</tr>
<tr>
<td></td>
<td>Perumbavoor, Ernakulam</td>
</tr>
<tr>
<td><strong>V. Padinanabhan</strong></td>
<td>Kanichayi House</td>
</tr>
<tr>
<td></td>
<td>Allapra P.O., Ernakulam</td>
</tr>
<tr>
<td><strong>V.V. Sasidharan</strong></td>
<td>Jyothy Wood Industries</td>
</tr>
<tr>
<td></td>
<td>Mudikkal P.O., Perumbavoor, Ernakulam</td>
</tr>
<tr>
<td><strong>A.P. Narayanan</strong></td>
<td>Puthupariyaram P.O., Malappuram</td>
</tr>
<tr>
<td><strong>Ali Kuppanath</strong></td>
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<td><strong>Ismail P.C.</strong></td>
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<td><strong>K. Abdul Jabhar</strong></td>
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<td><strong>K. Manzoor</strong></td>
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8. **Wood Technology Clinic held at KFRI Nilambur Sub centre, Malappuram**
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<td>Noushad M.</td>
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<td>P.P. Wood Industries Kozhiparambu Punnapal P.O., Malappuram</td>
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<td>Madhusoodanan A</td>
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<td>P.G. Thoufeek</td>
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<td>Pushparaj K</td>
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<td>Sreekumar M.</td>
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<td>Thajudheen C.P.</td>
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</table>
9. Wood Technology Clinic held at IRTC, Mundoor, Palakkad Dt. Kerala

Names and addresses of the participants not recorded

10. Wood Technology Clinic held at KITCO, Kottayam Dt, Kerala

Names and addresses of the participants not recorded

11. Wood Technology Clinic held at IRTF, Kottayam Dt, Kerala

A. John, Architect
Ansons' Group, Union Building
Kottayam

Achen K. Mathew
Thirumoolapuram P.O.
Thiruvalla, Pathanamthitta

Benzy Jerome
'Gethsemane'
Perumbikadu P.O., Kottayam

Biju Bastin
Mathirampuzha
Athurampuzha, Kottayani

Bijumon
Panakkal House
Sulthanbathery, Wayanad Dt.

C.S. Asok Kumar
I.E.O.
Kottayam

C.I. Kurian
Chackalayil House
Erayal Kadavu, Kottayam

G. Sudha
J.R.F, P.C.K. Ltd
Muttambalam, Kottayam

Dr. M.G. Kumaran
Joint Director
Rubber Board, P.O. Kottayam

Harilal .P.
Meenachil Rubber Wood Pvt. Ltd
Muttambalam P.O., Kottayam

K.N. Rajendran
Kalarickal Furniture Mart
Ponkunnam, Kottayam

K.S. Anitha, AD1O
Kanjirappilly
Kottayam

K.V. Sarathchandran
I.E.O., Meenachil
Pala, Kottayam

M.N. Babu
Malankara Wood Pvt. Ltd
Kodimatha, Kottayam
Manoj Joseph Kurian  
Kuttiyil House  
Athirampuzha, Kottayam

Mohana Chandran Nair  
Dy. Director (Engg).  
Rubber Research Institute of India,  
Puthuppally, Kottayam

N. Balachandran Nair  
I.E.O., Erattupetta Block  
Erattupetta P.O., Kottayam

P.I. Xaviar, GM  
D.I.C.  
Kottayam

P.P, Viswanathan Nair  
Puthedathu House  
Pallakadavu P.O., Kottayam

Rajendran  
‘Sreeragam’  
S.H. Mound P.O., Kottayam

Rema V.K., I.E.O.  
Taluk Industries Officer  
Vaikom, Kottayam

Renu Ben  
A.D.I.O., D.I.C.  
Kottayam

Sahu George  
Woodland  
Pulickal Trade Center  
S.H. Mount P.O., Kottayam

Shaji K.J.  
Koottungal House  
Vazhakkulam P.O., Muvattupuzha

Suresh Babu  
Innovative Group, Citizen Complex  
Thalassery, Kannur-6

T. Shjio, A.D.I.O.  
‘Taluk Industries Officer  
Vaikom, Kottayam

T.C. Raveendran  
Mini Wood Industries  
Chenappady P.O., Kanjirappilly, Kottayam

Thomas Joseph, A.D.I.O.  
Taluk Industries Officer  
Meenachil, Pala, Kottayam

Thresiamma John, I.E.O.  
Taluk Industries Officer  
Vaikom, Kottayani

V.B. Vijayalakshmi  
Karthika Nousc, Vellassery  
Kaduthuruthy P.O.  
Kottayam

V.J. Mathew  
Meenachil Rubber Wood Pvt. Ltd  
Muttambalam P.O. Kottayam

Zakeer Hussain  
Parayil Purayidathil  
Kannimala P.O., Erumely, Pathanamthitta
12. Wood Technology Clinic held at St. Thomas’ College Thrissur, Kerala

*Names and addresses of participants not recorded*

13. Wood Technology Clinic held at Sree Narayana College, Nattika, Thrissur, Kerala

*Names and addresses of participants not recorded*

**Open House Programmes**

(1) 1999 September 16, 18, 20, 27, 28

<table>
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<tr>
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## Appendix 4
### List of beneficiaries

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<td>College of Horticulture, Kerala Agricultural University (KAU), Mannuthy, Thrissur Dt., Kerala (Students)</td>
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<td>Center of Science and Technology for Rural Development (COSTFORD), Ayyanthole P.O, Thrissur Dt., Kerala (Engineers)</td>
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<td>Nirmithi Kendra, Chettuva, P.O, Thrissur Dt., Kerala (Engineers)</td>
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<td>4</td>
<td>District Industries Centre (DIC), Ayyanthole P.O, Thrissur Dt., Kerala (Entrepreneurs)</td>
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<td>5</td>
<td>Forest Industries Travancore Ltd. (FIT), Aluva P.O, Eranakulam Dt., Kerala (Entrepreneurs)</td>
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<td>6</td>
<td>Ollur Grama Panchayath, Ollur P.O, Thrissur Dt., Kerala (Entrepreneurs)</td>
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<td>7</td>
<td>Saw Mills Owner's Association (SMOA), Perumbavoor P.O, Ernakulam Dt., Kerala (Entrepreneurs)</td>
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<td>8</td>
<td>Integrated Rural Technology Centre (IRTC), Mundoor P.O, Palakkad 678 592, Kerala (Volunteer R &amp; D workers)</td>
</tr>
<tr>
<td>9</td>
<td>Kerala Industrial Technology Consultancy Organization (KITCO), Reg. Office: P.B. No. 1820, Ravipuram. M.G. Road, Cochin 682 016, Kerala (Entrepreneurs, Engineers)</td>
</tr>
<tr>
<td>10</td>
<td>Indian Rubber Wood Task Force (IRTF), Malankara Buildings, Kodimatha, Kottayam 686 039, Kerala (Entrepreneurs)</td>
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<td>11</td>
<td>Post Graduate Dept of Botany, St. Thomas’ College, Thrissur, Kerala (Students)</td>
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<td>12</td>
<td>Post Graduate Dept of Botany, Sree Narayana College, Nattika P.O, Thrissur Dt., Kerala (Students)</td>
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<td>14</td>
<td>Eng. T.A. Mathew, Furniture Industry, X1X/51 MG Road, Thrissur 4, Kerala (Entrepreneurs)</td>
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FIGURES
Fig 1. Solar kiln

Fig 2. Inside view of solar kiln

Fig 3. Schematic diagram of the pilot plant for vapour phase ammonia treatment of wood

1. Treating cylinder
2. Ammonia storage tank
3. Vacuum pump
4. Vacuum cum pressure gauge
5. Safety valve
6. Mesh wire shelf
7. Wood specimens
8. Water container
9. Pressure regulating valves
(10+11+12) Valves

Fig 4. Ammonia plasticization plant

Fig 5. Moulds for bending plasticized wood
Fig 6. Metal straps and clamps for bending plasticized wood

Fig 7. Bent wood furniture

Fig 8. Fumigation chamber

Fig 9. Handicraft item prepared with *Eucalyptus grandis* - before (left) and after (right) fumigation

Fig 10. Furniture made with treated rubber wood
ENCLOSURES
(Paper cuttings)
Fig 11. Wood technology clinics and open house programmes
List of Newspaper clippings enclosed

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നമുക്ക് കേന്ദ്രപ്രഭാവത്തിൽ

15 മേയ് 28 നാൾ

1999 എന്റിപ്പോണവും  എന്റി-GL

1999 എന്റി-GL

1999 എന്റി-GL

1999 എന്റി-GL

1999 എന്റി-GL
വരി ഗ്യാന്ത്രിക:
'നേരിയ തെർമ്മാവുള്ള കാളിമേലാന്ത'
മുഖ്യനിർദ്ദേശം

ഇന്ത്യയിലെ തമിഴ്‌നാട്ടിലാണ്‌ സെന്ററൽ കാമറാരുകൾക്ക് ഏറ്റവും കുറവ് സൗകര്യമുള്ള സ്ഥലങ്ങളിലൊന്നാണ്‌. ഇവിടെ നിന്നും പ്രധാന മൃഗാന്തം കൊണ്ട് പ്രതികാരം ലഭിക്കുന്നു. സെന്ററൽ കാമറാരുകൾ കൊണ്ടുള്ള മൃഗാന്തങ്ങളുടെ സമ്പൂർണ്ണത വര്‍ത്തനങ്ങളുടെ സഹായത്തോടെ നടക്കുന്നു. മുഖ്യനിർദ്ദേശം ഇതിനൊപ്പം അണ്‌ പ്രധാനമായും കാമറാരുകൾക്ക് സുരക്ഷ നിരക്കുകയും ചെയ്യുന്നു. തമിഴ്‌നാട്ടിലെ സെന്ററൽ കാമറാരുകളുടെ സാമൂഹ്യാന്തിക പ്രവൃത്തികളും പ്രധാനപ്രാധാന്യമുള്ള സന്ദർഭങ്ങളിലൊന്നാണ്‌.
മൃദന്തം വംശശാലയാണ്

മൃദന്തം വംശശാലയാണ്

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KFRI to hold wood tech clinic

**EXPRESS NEWS SERVICE**

Thrissur, Sept 13: Upgradation of the existing technology along with introduction of new techniques in the preservation and use of wood has become inevitable for the survival of wood-based industries in view of the increasing shortage of timber, according to J K Sharma, Director of Kerala Forest Research Institute.

The shortage has also made the use of secondary alternative timbers after treating them for durability, strength and attractiveness, he told mediapersons here today.

Sharma and other scientists of the Wood Science Department of the institute said in order to popularise certain selected technologies in the field, Kerala Forest Research Institute will be conducting wood technology clinics and open house programmes in different parts of the State.

Use of solar timber drying kiln plasticising wood for making bendwood furniture and fumigation technique for improving the durability and attractiveness of the furniture, etc. will be some of the topics on which experts will dwell at the technology clinics to be held in different parts of the district during September.

The open house programme will be held at Kerala Forest Research Institute on September 15, 16, 18, 20 and 28.

The programme is being conducted with the financial assistance of Indian Council of Forestry Research and Education.
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രാജ്യത്തിന്റെ അധ്യക്ഷനെയ്‌റ്റ് വസ്നാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു. രാജ്യത്തിന്റെ അധ്യക്ഷനെയ്‌റ്റ് വസ്നാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു. പിന്നീട് അതേക്കുലോകമായി അതേസ്ഥാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു. പിന്നീട് അതേക്കുലോകമായി അതേസ്ഥാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു. പിന്നീട് അതേക്കുലോകമായി അതേസ്ഥാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു. പിന്നീട് അതേക്കുലോകമായി അതേസ്ഥാനം കെല്ലാമ്പിൽ വിരിഞ്ഞു.
നിരോധിക്കുന്നതിന് ചില രാജ്യങ്ങൾ പരിസ്ഥിതിയിൽ നാല് സമയങ്ങളിലാണ് നാല് നിയമങ്ങളുടെ സ്ഥാപനം നടക്കുന്നത്. പ്രഥമ 27-ാമക്കാലത്തുള്ള കാലാവധി പരിസ്ഥിതി, ഇന്ന് 17-മാസം പരിസ്ഥിതി, പന്തുകളുടെ സമയം ഒറ്റിട്ടുണ്ട്. വാർഡ് മാസം പരിസ്ഥിതി, നാല് നിയമങ്ങളിലെ പരിസ്ഥിതിയിൽ സാധ്യമാണ്. വാർഡ് മാസം പരിസ്ഥിതി, നാല് നിയംകളുടെ പരിസ്ഥിതിയിൽ സാധ്യമാണ്.
2 T4 T4A 1999 ഡിസംബർ 21 താഴ്സ്

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മലയാളി വെബ്സൈറ്റ് 22ൽ റിലീസ്

1999 ഡിസംബർ 22 മാസം

മലയാളി വെബ്സൈറ്റ് 22ൽ റിലീസ്
മൂന്ന് വികസനസാവധി

1999 ഡിസംബർ 23 സുവർണ്ണം 3

യുദ്ധം വികസനസാവധിയുടെ കാലത്ത്

മൂന്നാം വികസനസാവധിയുടെ കാലത്ത്, കേരളത്തിലെ ഉമ്മെലികളുടെ വികസനസാവധിയിൽ നിന്ന് വികസനസാവധിയുടെ ഉത്സവം സജീവമായിരുന്നു. സാമൂഹ്യ സ്വാക്ഷീപ്തി, സാമൂഹ്യ പ്രവർത്തനം എന്നിവയ്ക്ക് നല്ല സ്വാധീനം നൽകിയിരുന്നു. സാമൂഹ്യ സാമ്പത്തിക വികസന പ്രവര്‍ത്തനങ്ങളിലെ നല്ല സ്വാധീനം നൽകിയിരുന്നു. സാമൂഹ്യ പ്രവർത്തനങ്ങളിലെ നല്ല സ്വാധീനം നൽകിയിരുന്നു. സാമൂഹ്യ പ്രവർത്തനങ്ങളിലെ നല്ല സ്വാധീനം നൽകിയിരുന്നു.

maalayalam newspaper page