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INDIA

Technical report: Slow release formulations*

Prepared for the Government of India
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of B. Shasha, consultant on
slow release pesticide formulation

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* This document has not been edited.

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ABSTRACT

During my short visit at this Centre, I made a special effort to meet and discuss scientific and non-scientific subjects with each of the professional staff. The morale is generally upbeat and a strong commitment and progress were made since my last visit to work hand in hand with industry. Generally, my lectures were concentrated on controlled release techniques and on commercialization of invention through patenting. The recent topic was not a part of the job description and was included after discussions with UNIDO staff member, S.P. Dhua and K. Dhari. The decision seems to be both timely and appropriate. That's so due to recent privatisation and liberalisation of India's economy and also due to the fact that's the first time a UNIDO Consultant addressed here such an important subject. In my opinion, this institute is at a cross-road and it is time to make some major decisions (see Recommendation section for details)

INTRODUCTION

This is my second mission to the Pesticide Development Centre at Gurgaon, Haryana. My first visit which was in the spring of 1990 included consulting on botanical pesticides and participating in a regional workshop concerning controlled release of pesticides.

As for this tour, the purpose is to develop user and environmentally friendly formulations suitable to India's needs. My duties at the Centre will be to advise and conduct experiments in encapsulation of pesticides for slow release using biodegradable matrices, take up new projects that have commercial application, assist in conducting workshops and participate in group discussions.

Following my brief visit with UNIDO staff member _____ and discussions with M/s. K. Dhari and Dhua, it was decided to introduce the scientists here to the field of patents and especially patents applications for commercialisation of inventions. Also, it was decided to try to involve interested scientists from local research institutions and industries.

RECOMMENDATIONS

After discussions with M/s Sugavanam, Dhari, Dhua and every scientist at the Centre, it became obvious that since my last visit here improvements have been made in terms of a strong cooperative efforts with the pesticide industry. Some very diverse problems were tackled and solved satisfactory.

But, how about the future say 5 or 10 years from now? I think we are currently at a crossroad and TIME IS A NEGATIVE FACTOR. Indeed, we have to make some very basic decisions. Such as : Do we want educational, service, research centre or all of the above? What type of pesticide will be our highest priority: Chemical, biological, botanical or again all of the above? and do we have the necessary and appropriate scientific and administrative staff?

Here is my roadmap: to start with, the present building and location may not be fit for all. We cannot expect our scientists to be very creative in hot summer of Delhi, the cold winter if they are not provided with comfortable offices and laboratories. Our quality control is suspect in the botanical pesticide laboratory. We cannot rear insects for biological testings in atmosphere of Malathion vapor coming from other laboratories.

Obviously there is a strong need for the Centre. It is up to us! We can create a Centre of excellence and making it a national treasure, a showcase that India and indeed the whole region will be proud to associate with. We need a commitment for success, a new partnership between government and industry which UNIDO plays advisory role. We need a modified structure suitable for pesticide research with an upto date computerised library. We should try to attract the highest qualified scientists and administrators and pay wages accordingly. Such an institution will have a board of trustee composed of the parties involved and should decide on research priorities.

Three separate sectors, independently budgeted will be created: educational sector - to train for a fee technical personnel in the field of pesticide analysis and formulation; general service sector - to solve acute problems for the industry on a cost plus basis; and research sector. Each of the sectors is equally important although not equally budgeted. The research part cannot be expected to survive for long unless it has something to sell which is innovation. Creativity will be at premium and will be marketed through patenting nationally and more importantly internationally. At the same time, research efforts can be streamlined and focused with programmes responsive to national needs followed by possible breakthrough products. For all this there is a potential for IPFT.

Lectures and Discussion

During my mission, I delivered and led 2 consecutive lectures - discussions on patents and their application, to scientific and non-scientific personnel. That was a first time presentation by any UNDP - Consultant on this important area. The presentation were held at UNDP conference room at Lodi Estate, New Delhi. Among the subjects covered were: examples of some patents and their subsequent importance; patents as an intellectual property; invention versus discovery; evaluating an invention; determination of inventorship; when an invention is complete; common-law rights/ patents; advantages and disadvantages; the importance of literature search; type of patents; the best and most convincing way to document your invention; the pitfalls of publication; writing a rough draft of patent application; how to improve your chances for success.

I made also 2 presentations on controlled release technologies to scientific personnel from the centre here and University of Delhi. Among subjects covered were: the importance of a research institute to team work with

industry: requirements for an acceptable controlled release formulation; Methodology of chemical and biological encapsulation; creation of a microsphere; quality testing; factors affecting rate of release; when NOT to encapsulate; preparation and properties of adherent particles and large scale preparation. A copy of an article that I prepared for UNIDO as a book chapter and entitled "Economics and Technologies of Controlled Release Formulations of Pesticides" was presented to the sponsors. The article is included herein as Appendix.

Programme Reviews

1. With Mr. A. Agrawal : Within the last year, Mr. Agrawal spent 3 months at our Agricultural Research Centre in Urbana, Illinois. He proved to be capable and innovative scientist and I strongly encouraged him to continue his education toward a Ph.D Degree. At our Centre, he was trained in the field of controlled release of pesticides using natural products as a wallmatrix. Among the procedures used was starch derivatized in the presence of liquid or solid volatile or non-volatile active ingredients, followed by cross-linking the starch to form solid, granular matrix suitable for conventional agricultural uses. All samples were then analysed for percentage of active ingredient, degree of encapsulation and for rate of release under dry and high moisture conditions. Extensive search through chemical abstracts and relevant patent literature was also undertaken. For further details see his final report submitted to UNDP Office.

Upon his return, Mr. Agarwal extended his effort in this field by substituting starch with wheat straw. This is a bio-degradable, inexpensive and abundant commodity. Preliminary trials indicated that about 30% of wheat straw can be extracted under mild alkali condi-

tions. The extract, due to its polymeric nature has the potential to be used, upon cross-linking, as a solid matrix to encapsulate certain pesticides. I suggested that the straws be hammer-milled to obtain a fine powder that passes 30 mesh, followed by alkali treatment to obtain high concentration of solids. Pesticides (initially simulated by using vegetable oil) will be included with the mixture followed with the addition of calcium chloride as a cross-linking reagent. The product will be viewed and analysed as above. If successful, the vegetable oil will be substituted with pesticide. Replacing a small portion of the powdered straw with ungelatinised starch is another option to be considered.

2. With Dr. P.K. Patanjali : Dr. Patanjali is Sr. Colloid and Surface Chemist at this Institute. Recently he developed an economical, with a better shelf-life of a popular insecticide, than any available formulation. I spent much time discussing his invention advising comprehensive literature search for a potential patent application. I am aware of the unfortunate patent "hazards" in this country but an application in Europe, Canada and the USA should definitely be considered. I strongly recommend against selling an exclusive rights without exploring fully its merits. I did instruct Dr. Patanjali about some of the intricacies of patent application and he did attend my lecture on the subject.
3. With Dr. N.R. Bhatishwar : In cooperation with Dr. Y.P. Ramdev, Dr. Bhatishwar researched some 12 plants for botanical insecticide activity. All the plants were identified by their botanical names. Leaves, fruits and seeds of each were extracted with hexane, ethyl acetate and

alcohol and analyzed for their biological activities. The results of newer microbial formulation against mosquito larvae which were published in the scientific journals were encouraging and indicate some commercial applications. I suggest again that patent consideration should not be overlooked.

4. With Dr. S.Y. Pandey : During my short visit here I found Dr. Pandey very busy either preparing for the training programme on pesticide analysis or conducting the programme almost exclusively. The programme was held November 16-27, 92 for the benefit of the technical personnel of Bureau of Indian Standards. I did chair a technical session during which Dr. Pandey gave an excellent presentation on "Chemical Methods of Analysis". Analytical division has done good work on method development and this department needs strengthening and encouragement. Due to very limited access to sophisticated instrumentation for our most attendee in the training course, more emphasis should be made for the availability of simple kits or spot tests for qualitative and even quantitative analysis of certain pesticides. Dr. Pandey during his presentation gave an excellent example of just this type for some chlorinated phenyl insecticides.

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UNIDO COMMENTS

The expert, Mr. Shasha's report gives valuable information on the type of work that could be carried out in high tech formulations using simple biological matrices. His observations that the Institute of Pesticide Formulation Technology (IPFT) should concentrate on those areas in which they have the competence to provide service to local industry and to the region should be further analyzed in order to streamline activities. This would be cost effective and the centre can provide suitable services in accordance with the national/international standards.

The general talk on patents given by the expert is very timely and hopefully the participants would have found it useful at a time when the Government is seriously pursuing economic reforms.

The training provided by the author to the counterparts both in IPFT and in his laboratories in USA would provide the linkages between the expert and the trainees which is always very cost effective.