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A REVIEW ON USES OF CASHEW NUT SHELL LIQUID, NEEMSEED OIL, KARANJ OIL AND BHILAWAN SHELL LIQUID IN AGRICULTURE FOR SAFE ENVIRONMENT

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Abstract: Green revolution in agriculture has come with huge application of insecticides, pesticides, termiticides, fungicides, wood preservatives and wood polishers. In the want of more food for ever growing population, use of insecticides and pesticides have been crossed the boundaries of safe level.

Keywords: MRL- minimum risk level, CNSL- cashew nut shell liquid,

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INTRODUCTION

Green revolution in agriculture has come with huge application of insecticides, pesticides, termiticides, fungicides, wood preservatives and wood polishers. In the want of more food for ever growing population, use of insecticides and pesticides have been crossed the boundaries of safe level. Because of increasing urbanization, rate of deforestation has been increased as well as use of paints, varnishes, wood preservatives and wood polishers has also been increased. Most of the chemicals used for above purposes are hazardous and therefore banned in many developed countries but unfortunately still in use in developing countries world over (UNEP, 2000; Venkateswara et. al., 2005) in many countries which has serious deleterious impacts on non-targeted biotic and abiotic factors of environment (Pimental 1995).

Therefore it is necessary to focus on utilizing Cashew nut shell liquid (CNSL) as the prominent and safe alternative to be utilized in agriculture as insecticide, pesticide, fungicide, termiticide, wood preservative and wood polisher. The area under cashew nut is increasing in under the special Employment Guarantee Scheme on 100 percent subsidy in India. Cashew nut shell liquid has potential to become an environment friendly substitute for hazardous chemicals especially in agriculture may be with other plant based chemicals or alone.

Review of Literature

Impact through spraying pesticides and herbicides

No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country (WHO, 1990). The world-wide deaths and chronic diseases due to pesticide poisoning number are about 1 million per year (Environews Forum,1999).The high risk groups exposed to pesticides include production workers in industry, formulators, sprayers, mixers, loaders and agricultural farm workers. In industrial settings, workers are at increased risk since they handle various toxic chemicals including pesticides, raw materials, toxic solvents and inert carriers. OC compounds could pollute the tissues of virtually every life form on the earth, the air, the lakes and the oceans, the fishes that live in them and the birds that feed on the fishes (Hurley et al., 1998).

In a study on workers (N=356) in four units manufacturing HCH in India revealed neurological symptoms (21%) (Nigam et al., 1993), cardiotoxic effects of methomyl, significant changes were noticed in the ECG, the serum LDH levels, and cholinesterase (ChE) activities in the spraymen (Saiyed et al., 1992), generalized symptoms (headache, nausea, vomiting, fatigue, irritation of

skin and eyes) besides psychological, neurological, cardiorespiratory and gastrointestinal symptoms coupled with low plasma ChE activity (Gupta et al., 1984). Data on reproductive toxicity in males associated with the spraying of pesticides in cotton fields revealed the adverse effects on functions of liver, immunity, neurologic impairment, and reproductive effects. An excess mortality from cardiovascular and respiratory diseases was observed, possibly related to the psychosocial consequences of the accident in addition to the chemical contamination. An excess of diabetes cases was also found. Results of cancer incidence and mortality follow-up showed an increased occurrence of cancer of the gastrointestinal sites and of the lymphatic and haematopoietic tissue (Rupa et al., 1991, Gupta et al., 1982).

Impact through food commodities

Under the programs entitled 'Monitoring of Pesticide Residues in Products of Plant Origin in the European Union' started since 1996, most of the pesticides (acephate, chlopyriphos, chlopyriphos-methyl, methamidophos, iprodione, procymidone and chlorothalonil) were analysed (9700 samples) in apples, tomatoes, lettuce, strawberries and grapes and found to contain residues higher than the respective MRL for that specific pesticide. In India the first report of poisoning due to pesticides was from Kerala in 1958, where over 100 people died after consuming wheat flour contaminated with parathion (Karunakaran, 1958). This prompted the Special Committee on Harmful Effects of Pesticides constituted by the ICAR to focus attention on the problem (Report of the Special Committee of ICAR, 1972). In a multi-centric study to assess the pesticide residues in selected food commodities collected from different states of the country (Surveillance of Food Contaminants in India, 1993), the proportion of the samples with residues above the tolerance limit was highest in Maharastra (74%), followed by Gujarat (70%), Andhra Pradesh (57%), Himachal Pradesh (56%), and Punjab (51%). In the remaining states, this proportion was less than 10% (Kannan et al., 1992).

Impact on environment

Pesticides can contaminate soil, water, turf, and other vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants. Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms.

Surface water contamination

Contamination of surface water by pesticides is widespread through runoff from treated plants and soil. In the set of studies done by the U.S. Geological Survey (USGS) on major river basins

across the country in the early to mid- 90s shows that more than 90 percent of water and fish samples from all streams contained one, or more often, several pesticides commonly exceeded guidelines for protection of aquatic life (Kole et al; 2001, Bortleson and Davis, 1987–1995, U.S. Geological Survey, 1999).

Ground water contamination

Pollution of groundwater due to pesticides is a worldwide problem. In India, 58% of drinking water samples drawn from various hand pumps and wells around Bhopal were found contaminated with Organo Chlorine pesticides above the EPA standards (Kole and Bagchi, 1995). Once ground water is polluted with toxic chemicals, it may take many years for the contamination to dissipate or be cleaned up. Cleanup may also be very costly and complex, if not impossible (1998; US EPA, 2001).

Soil contamination

Because of application of number of chemicals as pesticides, insecticides, fungicides, herbicides and chemical fertilizers there are residues found in soil everywhere in the world. Some of them can be moved from soil by runoff and leaching, thereby constituting a problem for the supply of drinking water to the population (Andreu and Pico, 2004).

Effect on soil fertility (beneficial soil microorganisms)

Plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use. Pesticides and herbicides disrupt this process depleting the population of beneficial soil microorganisms and fungi (Savonen, 1997).

Contamination of air, soil, and non-target vegetation

Pesticide and herbicide sprays can directly hit non-target vegetation, or can drift or volatilize from the treated area and contaminate air, soil, and non-target plants. Some pesticide drift occurs during every application, even from ground equipment (Glotfelty and Schomburg, 1989). Drift can account for a loss of 2 to 25% of the chemical being applied, which can spread over a distance of a few yards to several hundred miles. As much as 80–90% of an applied pesticide can be volatilised within a few days of application (Majewski, 1995). Herbicides kills targeted as well as non targeted plants, so they can injure or kill desirable species if they are applied directly to such plants, or if they drift or volatilise onto them (Straathoff, 1986). In addition to killing non-target plants outright, it can cause sublethal effects on plants, increase the

susceptibility of certain plants to disease. This poses a special threat to endangered plant species (Brammall and Higgins, 1998).

Non-target organisms

Pesticides and herbicides are found as common contaminants in soil, air, water and can harm plants and animals ranging from beneficial soil microorganisms and insects, non-target plants, fish, birds, bees, spiders and other wildlife (U.S. EPA, 1996;1998, Liong et al., 1988). Birds, fish and other marine animals have adverse effects on the reproductive and immunological functions in captive or wild aquatic mammals and plants (Helle et al., 1976). The Ganges river basin is densely populated and heavily polluted by fertilizers, pesticides, and industrial and domestic effluents and observed containing concentrations of heavy metals and hazardous chemical residues (Kannan et al., 1997).

Most of the insects and pests are feeding on plant parts above the ground and damage is visible therefore farmers take action of pest control by appropriate way but termite is yet to be considered as a prominent pest in agriculture although it is causing the loss of field crops, orchards, live trees, wood structures and furniture. They can eat lingo-cellulosic material in the form of grass, wood, crops, seedlings, clothes etc. 24 hours a day. Termites are one of the most agriculturally important insects and are known to cause enormous economic losses to many crop plants in various stages of growth and tree species, buildings, etc.(Mitchell, 2002). It is observed to cause severe losses (50-100%) in sugarcane, maize, wheat, fruits (Salihah et. al., 1986; Sattar and Salihah, 2001).

Effect of wood preserving and polishing chemicals on health

There are three types of wood preservatives creosote and creosote solutions, oil-borne preservatives and waterborne preservatives (inorganic arsenicals) which cannot be used in houses and other living areas due to toxic fumes irritating to plants, animals humans and leached chemicals pollutes drinking water sources causing danger to aquatic life.

Alternatives to using treated timber may include substitution with other materials where possible. For example: use concrete piles, strip foundations, recycled hardwood or concrete block retaining walls instead of piles or posts, use heartwood timbers such as western red cedar or redwood for weatherboards, decking, and so on instead of hazardous chemical treated timber, use Douglas fir, Lawson cypress or kiln-dried radiata pine instead of boric-treated timber where the in-service moisture content will always be 18% or less. Many plant sources

are having some insecticidal and fungicidal properties and environment friendly, can be accessed for the wood preservation (Lebow, 1996).

Materials and Methods

Chemicals used as insecticides, pesticides, fungicides, wood preservatives and wood polishers are available in the form of gas, liquid and solid form, but are costly and hazardous to human, animals and environment. Natural tree borne oils (CNSL, Karanj oil, Neemseed oil and BSL etc.), and other plant sources having constituents responsible to act as either anti-feeder or repellent or killer of insect, pest and fungi as well as preservative or polisher of wood will be environment friendly alternatives.

Cashew nut (*Anacardium occidentale* L.) shell yields reddish brown, viscous, strongly vesicant cashew nut shell liquid (CNSL) about 30-35% weight of the cashew nut. Cashew nut shell liquid consist of 80-90% anacardic acids (AA) and 10-20% cardol, depending upon the variety of the nut and geographical locations where it is grown (Behrens,1996). India has a potential of producing about 1.5lakh tones of CNSL per year (Mahrashtra-30000tones/year) but only 45000tones/year is produced. In Maharashtra, Konkan region produces about 20000tones of CNS/year from which about 7000-8000tones of CNSL can be obtained (Mohod et al, 2010).

Anacardic acid (AA), a bioactive phytochemical, is a mixture of several closely related organic compounds, each consisting of salicylic acid substituted with an alkyl chain. The traditional Ayurveda depicts AA as a medicinal remedy for alexeritic, amebicidal, gingivitis, malaria and syphilitic ulcers. It has been observed that AA could be a potent target molecule with bactericide, fungicide, insecticide, anti-termite and molluscicide properties and as a therapeutic agent in the treatment of the most serious pathophysiological disorders like cancer, oxidative damage, inflammation and obesity (Venmalar and Nagarveni, 2005).

Neemseed (*Azadirachta indica*) consists of 25% to 45% non edible vegetable oil, golden yellow, yellowish brown, reddish brown, dark brown, greenish brown or bright red in colour. It consists of Linoleic acid, Oleic acid, Hexadecanoic acid, Octadecanoic acid, Alpha-linolenic acid and 9-Hexadecenoic acid. Azadirachtin is the most active triterpenoid in neem oil, varies from 300ppm to over 2500ppm and can be used as a household pesticide for ant, bedbug, cockroach, housefly, sand fly, snail, termite and mosquitoes. It is also reported that it shows promising termiticidal and repellent activities by no-choice test and standard test EN 118, 2005 and not known to be harmful to mammals if not concentrated directly into the food source (Djenontin *et al*., 2012, Rajeev, 2009).

Karanja (*Pongamia pinnata*) seed consists of oil-27% -39%, yellowish-orange to brown in color and toxic. Oil consists of active fatty acids which vary as per season and maturity of the tree (Karmee *et al*., 2005). It has a high content of triglycerides with disagreeable taste and odor due to bitter flavonoids (Scott *et al.,* 2008). It is reported that formulation of karanj oil -10-35%, neemoil 10-30% and sesme oil 2-10% infused with orange peel 1-4%, extracts of Acorus spp., 1-10% Alluium spp., 1-5% Vitex spp., 1-2% of essential oil residue and CNSL is useful for termite control (Vishal *et al.*, 2010).

Marking nut (*Semecarpus anacardium* L.) seed pericarp contains black, oily bitter and highly vesicant juice known as Bhilawan Shell Liquid (BSL) constituting of 46% by weight of nuts. It is a rich source of phenolic compounds and biflavonoids is used in production of insecticides, antiseptics, termite repellents and moth proofing agents, in synthetic detergents, herbicides and fire proofing industries (Rahman *et al*. 2008).

Many other tree borne oils as well as plant parts such as leaves, roots, barks, flowers, rinds or peels can be searched in the forest and can be utilized by single or by mixing two or more number of sources and their extracts can be used as alternatives to the use of hazardous chemicals posing threat to the biosphere, may be partly but will be the way towards making the environment safe for human for longer period of time. The aim of this article is to emphasize on the utilization of natural sources and reduce environmental pollution simultaneously to enhance the employment opportunities in rural area.

Conclusion

Although the earth is endowed with plenty of natural resources, they are yet to be utilized efficiently for different purposes which may develop the eco-friendly atmosphere for the biosphere in soil, air and water. The global warming and climate change problems are alarming to man to be aware of the causes of pollution. The data on environmental-cum-health risk assessment studies may be regarded as an aid towards a better understanding of the problem. Data on the occurrence of pesticide-related illnesses among defined populations in developing countries are scanty. Our efforts should include judgmental use of insecticides, pesticides, fungicides, wood preservatives and wood polishers chemicals and investigations of alternative ways and means as for as possible.

The total cost-benefit picture from pesticide use differs appreciably between developed and developing countries. For developing countries it is imperative to use pesticides, as no one would prefer famine and communicable diseases like malaria means to be expedient to accept a reasonable degree of risk. Our approach to the use of pesticides should be pragmatic i.e. all

activities concerning pesticides should be based on scientific judgment and not on commercial considerations. Because of large number of human variables such as age, sex, race, socio-economic status, diet, state of health, it is difficult to fully evaluate the risks to human health. But practically little is known about the effects of these variables.

Pesticides are often considered a quick, easy, and less expensive solution for controlling weeds and insect pests in urban landscapes which have contaminated almost every part of our environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds. Pesticide residues are found in soil and air, and in surface and ground water across the countries and contribute to the problem. Weed killers can be especially problematic because they are used in relatively large volumes. The best way to reduce pesticide contamination (and the harm it causes) in our environment is for all of us to do our part to use safer, non-chemical pest control (including weed control) methods.

Published literature in various sources has difference of opinion about the use of pesticides. By achieving economic benefits, social and environmental benefits should not be neglected at any of the level. The ultimate benefit that should be focused on global level is the safe existence of human on the earth for longer time.

This is high time to understand by every person, group of persons, institutions and governments in the world to plan the economic development in one hand and socio-environmental benefits in another hand for sustainable livelihood on the earth. There is thus every reason to develop health education packages based on knowledge, aptitude and practices and to disseminate them within the community in order to avail alternate natural resources and minimize human exposure to the controlled and justified use of pesticides.

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