



4th International IUPAC Conference on
GREEN CHEMISTRY



25 – 29 AUGUST 2012
Foz do Iguaçu/PR, Brazil

“Recycle @ SourceTM : A green chemistry tool as profitcentric perspective to recycle all liquid effluents”

Nitesh Mehta*, Bhadresh Padia, Rajesh Moholkar, Ragesh Angreji,

Mohan Anvekar, Minesh Shah and Dr Komal Maheshwari

Newreka GreenSynth Technologies Pvt Ltd

405, Master mind IV, Royal Palms, Aarey Colony,
off Western express highway, Goregaon east, Mumbai, India

nitesh.mehta@newreka.co.in

Keywords: Recycle@SourceTM, pollution prevention



INTRODUCTION

The mantra for development today is Industrialization. Over the past three decades the process industry sector in India grew with a non linear rate and proportionally the waste generated from these industries has also increased. The industry sectors contributing as major waste generators include pharmaceuticals, petrochemical, dye, agro chemical (fertilizers & pesticides).

Particularly pharma sector, India is emerging as one of the world's largest center for bulk drug production. The purity of the final product is the major concern of the bulk drug manufacturing industry and hence the rejects (unreacted/unrecovered product or filter loss) contribute to the major pollution load from industry. On an average synthesis of bulk drug involves eight chemistry steps and each step yields different kind of pollutant depending on the particular reactant and process. Second important and large sector of Indian chemical industry is Dyes and Dye Intermediates industry. This sector has grown at a very fast pace during the last decade, and is one of the largest producer of dyes and intermediates in Asia with nearly 70% of its production is being exported today.

The pollution generated by both these industries has heavy effluent load which is non-biodegradable nature of the intermediates as well as due to the presence of organic impurity along with acid/ alkali/ toxic trace metals/ carcinogenic aromatic amines in the effluents. The effluent generated from these intermediate industries usually have high level of COD, BOD, acidity, chlorides, sulphates, phenolic compounds and various heavy metals viz. copper, cadmium, chromium, lead, manganese, mercury, nickel, zinc etc.

The concept of CETP was introduced as a solution to the water pollution problem from this sector of industry. This concept has failed due to the varied nature of effluent received from different industries require different treatment methods. With growing industrialization and increased demands the CETP's are unable to cater the industrial sector. Many times the treatment is bypassed and the effluent is directly discharged in the water bodies.

The amount of waste generated has increased non-linearly with the growth of industrialization. CETP's are unable to handle the effluent loads generated from these industries, which results in severity of pollution. The primary focus here should be minimization of waste generation followed by effective treatment of waste. The waste generation needs to be monitored at each stage of product life cycle. The waste minimization can be one at source by

- Process optimization/modification to avoid untreatable pollutants generation
- Adaption of cleaner process options for reducing the water consumption and effluent generation.
- Segregation and reuse/recycle of treated effluent.
- Improvement in efficiency of process and recovery of by-products.

The concept of Recycle@Source™ works in the actual unit process and it is not the end of the pipe treatment as usually done in the industries just to make it eligible to throw in the water bodies. Since it is used at the place where it is generated, it is aptly named 'Recycle@Source™'. Since it is used at source, no further waste is generated and the same effluent can be used in place of fresh reactants number of times, hence effluents are not at all drained out, hence reducing or nullifying the effluent load in the water bodies.

One of the major advantages of Recycle@Source™ is that very minor or no changes in the plant hardware are required. This factor is important in changing mind set and helps in reducing inertia and reluctance. Another advantage is that implementation of Recycle@Source™ does not require huge investments which is a blessing in today's tight financial situation many chemical industries are passing through.

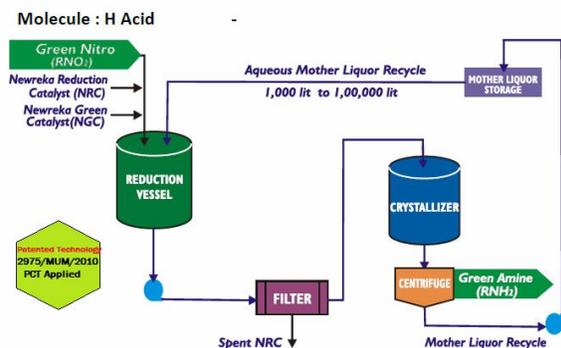
RESULTS AND DISCUSSION

Two examples are discussed herewith representing two different industry sectors.:

Nevirapine, also marketed under the trade name Viramune (Boehringer Ingelheim), is a non-nucleoside reverse transcriptase inhibitor (NNRTI) used to treat HIV-1 infection and AIDS. It prevents transfer of virus from Mother to child in womb. In its 7 step process to synthesize final API, first 4 steps generate effluent amounting to e-factor of 175. Applying Recycle@Source™ solution, e-factor was brought down to 17 with almost theoretical yield and quality matching the standard specification.

H-acid (1-amino, 8-naphthol, 3,6-disulfonic acid) & MPDSA (Meta Phenylene Diamine 4-Sulfonic Acid) are two largest dye intermediates used in the manufacture of acid, reactive and direct dyes. Both of these intermediate generate liquid effluent of e-factor 50 – 75 which is highly acidic in nature. By applying Recycle@Source™ technology, the effluent is recycled more than 25 times, thus reducing effluent load almost by 95 % and giving consistent quality and theoretical yield.

Figure 1. Recycle@Source™ concept



CONCLUSION

Recycle@Source™ is a simple method to recycle all the effluent streams of process back to its source without contaminating or degrading product quality. By applying this approach in manufacturing of any chemical product, triple bottom line of Planet, Profit and People can be served.