EDITORIAL

The water is a limited resource, so recycling of waste water becomes important. Soil Bio-technology is a technique for wastewater treatment which is based on the principle of bio-filtration. This system is combination of physical processes like sedimentation, infiltration and biochemical processes which are carried out to remove the suspended solids, organic and inorganic contents of the wastewater. This issue covers the features and principle of soil biotechnology which ultimately leads to sustainable development. “Environmental News and Events” are also included as a part of our meticulous write up.

GCPC welcomes Chairman, Shri. Manoj Aggarwal, IAS, VC & MD, GIDC, former Managing Director, GMDC in place of Shri. B.B. Swain, IAS Chairman GCPC and VC & MD, GIDC placed as Principle Secretary, Panchayat, Rural Housing and Rural Development, Government of Gujarat.

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- Open Windows of CP Centers in Latin America and Caribbean Region
- Cover Story: Soil Biotechnology
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- BEE Star Rating for Building
- Snapshots

ENVIS - GCPC

ENVIS CENTRE ON

CLEANER PRODUCTION & TECHNOLOGY

(Supported by Ministry of Environment, Forest & Climate Change, Govt. of India)
OPEN WINDOW
Cleaner Production Centers of Latin America and Caribbean Region

Centro Nacional de Tecnologias Limpas (Brazil)
http://www.senairs.org.br/pt-br/cntl

Centro Nacional de Producción Más Limpia y Tecnologías Ambientales (Colombia)
http://www.cnpml.org/

Centro de Promoción de Tecnologías Sostenibles (Bolivia)
http://www.cpts.org/

Asociación Paraguaya para la Calidad Centro de Ecoeficiencia (Paraguay)
http://www.apc.org.py/

Centro Mexicano para la Producción más Limpia (Mexico)
http://www.cmpl.ipn.mx/portal/

Centro de Eco-eficiencia y Responsabilidad Social (Peru)
http://www.cer.org.pe/
Soil Biotechnology is a waste-water treatment process, which is based on a bio-conversion process. In SBT the fundamental of nature viz. respiration, photosynthesis and mineral weathering take place in a media housing micro & macro organisms which bring out the desired purification. SBT is an oxygen supplying biological engine. It can treat all types of water – domestic, municipal and industrial.

Working Principle of SBT

The SBT system is an engineered ecology of soil plant system configured as a packed bed reactor with multi grade media consisting of different sizes of stone, gravel and formulated soil enriched along with micro flora and geophagus earthworm culture. Chemistry, Biology and Ecology in SBT facilitates both aerobic & anaerobic respiration, and reactions like nitrification, denitrification, acidogenesis, etc depending on the types of waste load. Organics get removed by adsorption & filtration and are biologically converted to CO2 with help of indigenous soil microflora. Suspended Solids are removed in Primary Settling Unit. Dissolved Solids are removed by adsorption followed by biodegradation and uptake by green plants. Media and additives provide sites for biological transformation. Earthworm culture regulates microbial ecology. Health of green plants bio-indicate the process.

Major Elements of SBT

I. Media which supports the micro & macro organisms of soil ecology for aerobic respiration which includes nitrogen fixation and active oxygen production.

II. Culture which includes geophagus worms serves as the top carnivore to regulate soil population.

III. Additives: a natural mineral mixture which regulates pH.

IV. Green plants to serve as bio indicator of the health of process. In view of the ecology of soil & engineered natural oxygen supply highly aerobic environment exists in the bioreactor.

Chemistry of Soil Biotechnology

Respiration

\[(\text{CH}_x\text{ON} \, y \, \text{P} \, z \, \text{S} \, K_n) \, n + \, n\text{O}_2 + \, n\text{H}_2\text{O} \rightarrow n\text{CO}_2 + 2n\text{H}_2\text{O} + \text{Mineral (N, P, S, K)} + \text{Energy}\]

Photosynthesis

\[n\text{CO}_2 + 2n\text{H}_2\text{O} + \text{Minerals (N,P,S,K)} + \text{Sunlight} \rightarrow [\text{CH}_x\text{ON} \, y \, \text{P} \, z \, \text{K}_n]n + n\text{O}_2 + n\text{H}_2\text{O}\]

Nitrogen Fixation

\[\text{N}_2 + 2\text{H}_2\text{O} + \text{Energy} \rightarrow \text{NH}_3 + \text{O}_2 \text{ (in soil)}\]
\[\text{N}_2 + 2\text{H}_2\text{O} + \text{Light} \rightarrow \text{NH}_3 + \text{O}_2 \text{ (in water)}\]

Acidogenesis

\[4\text{C}_3\text{H}_7\text{O}_2\text{NS} + 8\text{H}_2\text{O} \rightarrow 4\text{CH}_4\text{COOH} + 4\text{CO}_2 + 4\text{NH}_3 + 4\text{H}_2\text{S} + 8\text{H}^+ + 8e^-\]

Methanogenesis

\[8\text{H}^+ + 8e^- + 3\text{CH}_2\text{COOH} + \text{CO}_2 \rightarrow 4\text{CH}_4 + 3\text{CO}_2 + 2\text{H}_2\text{O}\]

Mineral weathering

\[\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}^+\]

Primary mineral + \text{CO}_2 + \text{H}_2\text{O} \rightarrow M^{n+} + n\text{HCO}_3^- + \text{soil/clay/sand}\n
Nitrification

\[\text{NH}_4^+ + \text{CO}_2 + 1.5\text{O}_2 \rightarrow \text{Nitrosomonas} + \text{NO}_2^- + \text{H}_2\text{O} + \text{H}^+\]
\[\text{NO}_2^- + \text{CO}_2 + 0.5\text{O}_2 \rightarrow \text{Nitrobacter} + \text{NO}_3^-\]
Denitrification

\[ 4\text{NO}_3^- + 2\text{H}_2\text{O} + \text{energy} \rightarrow 2\text{N}_2 + 5\text{O}_2 + 4\text{OH}^- \]

\[ \text{NO}_2^- + \text{NH}_4^+ \rightarrow \text{N}_2 + \text{H}_2\text{O} + \text{energy} \]

**SBT’s Unique Features**

- Low on energy consumption
- Low on mechanization, hence zero down time
- No disposables or process residues
- Potential for Zero Discharge
- No air or sound pollution. Free from foul odour
- Using natural ingredients against synthetic chemical
- Scalable to any size of operation
- Best option for decentralised wastewater treatment
- Ideal for getting high Green Rating, Carbon Credits
- Ideal option for implementation under CSR Schemes
- Colourful green landscape as a by-product
- Water recovery - 90% (Minimum)

**Water Reuse Possibilities after Treated Wastewater from Soil Biotechnology**

- Gardening
- Toilet Flushing
- In Construction activities and Industrial floor washing
- Car Washing
- For HVAC Cooling Tower
- Ground Water Recharge after getting desired norms of SPCB
- Release to Water Bodies

SBT systems are typically housed in RCC, stone-masonry or soil bunds and consists of an impervious contaminants. It starts with a under drain layer, above which lies a layer of media housing culture and bio indicator plants. Water initially passes through the additive layer and subsequently passes through the media. It can be run as single stage or multistage, depending on desired water quality. The recirculation is provided for further polishing if required.

**Industrial Application of SBT**

- Effective Recalcitrant COD handling
- Polishing unit for existing CETPs
- MEE condensate treatment for Pharma and Chemical Industries.
- Pharmaceutical Effluent (Formulation & API) Chemical Research Organizations (CRO’s), Biotech companies
- Ammonia rich wastewater: Fertilizer Industries
- Petrochemicals, Pesticides, Sugar Effluents, Distillery Condensate recycling
- Arsenic removal upto extent of 98.6 %
- Fe removal upto 97.5 %
- Phosphorous removal upto 93 %

**In Industry, technology is being extended for zero liquid discharge for following applications:**

- Pharma (API & Formulations)
- Petrochemicals
- Pesticides
- Textile
Sludge Generation
No sludge is produced. Bio-mineral fertilizer is produced as useful byproduct.

Chemical and biological sludge is produced as waste by product which needs further handling like dewatering and dry for disposal.

Energy
All conventional aerobic treatment processes are based on aqueous phase reaction and therefore mechanical aeration is energy intensive.

Process driven by Natural Aeration in engineered soil ecosystem it is also energy conservative.

Soil Biotechnology Impact & Sustainability

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conventional</th>
<th>Soil Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits of output</td>
<td>Separation of streams</td>
<td>Synthesis of resource (waste) molecules into usable output products</td>
</tr>
<tr>
<td>Odour</td>
<td>Pungent Smell due to ammonia and aerosols generated from aqueous phase aeration device</td>
<td>No possibility of aerosol generation. Smell control is achieved via natural additive addition and high rate ammonia oxidation</td>
</tr>
</tbody>
</table>

Case Study
Anupam Rasayan, Surat
http://www.sugam.in/projectgallery.html

Zydus Cadila, Ahmedabad
http://www.sugam.in/projectgallery.html

India launches air quality index to give pollution information
6 April, 2015 | BBC News

India has launched its first air quality index, to provide real time information about pollution levels. The index announced by Hon’ble Prime Minister Shri Narendra Modi, will initially monitor air quality in 10 cities. Last year the Environmental Preference Index ranked India 174 out of 178 countries for air quality. A World Health Organization (WHO) survey last year which found that 13 of the most polluted 20 cities in the world were in India. The capital Delhi was the most polluted city in the world the survey showed pollution is a leading cause of premature death in India says WHO. Mr. Modi said India has to take the lead in guiding the world on thinking of ways to combat climate change.

NCR states draw up action plan to tackle air pollution
By Vishwa Mohan,
TN | 14 April, 2015, 10.33AM IST

NEW DELHI: The Centre joined the long battle for improving the Capital's notoriously bad air quality by getting Delhi, Haryana, Uttar Pradesh and Rajasthan to commit to a three-month action plan to curb pollution in the National Capital Region (NCR). All four states agreed to take time-bound steps to address the problem and come out with a joint medium and long term strategy in July. Under the plan, civic agencies in Delhi and three neighboring states will enforce the ban on burning of waste, act against polluting vehicles, and set up automatic identification of overloaded vehicles at borders, phase out coal-based units and adhere to upcoming norms on handling of construction waste.
Government may make waste management a part of school curriculum By Vishwa Mohan, TNN | 1 May, 2015, 08.20PM IST

NEW DELHI: Aiming to achieve target of 100% waste segregation at source over the next three-four years through people's participation on a massive scale, the environment ministry will come out with comprehensive revised rules on waste management in the country by July 15. It will also write to the ministry of human resource development to make 'waste management' a part of school curriculum. Emphasizing on increased participation of people and use of new technology to make waste management more effective, Union environment minister Prakash Javadekar said interactions would be held with the HRD ministry soon for making "cleanliness drives" and "waste management" a part of school curriculum as it is easy to make children aware of the issue during their growing age.

Air quality monitoring stations to come up in more cities
PTI | 7 May, 2015, 07.07PM IST

NEW DELHI: The Government plans to set up air quality monitoring stations, which are presently functional at 10 places, in more cities in the country. The air quality monitoring stations is also proposed to be expanded to cover the state capital as well as those cities having a population of more than 46-million, Minister of State for Environment, Forest and Climate Change Mr. Prakash Javadekar informed Rajya Sabha today. Presently, air quality data for cities - Delhi, Mumbai, Chennai, Hyderabad, Bengaluru, Kanpur, Lucknow, Varanasi, Agra and Faridabad - are connected to Air Quality Index (AQI), which was launched by Prime Minister Narendra Modi on April 6 this year to disseminate air quality information.

Govt begins giving out daily air quality bulletin for 11 cities By Vishwa Mohan, TNN | 7 May, 2015, 03.56AM IST

NEW DELHI: Exactly a month after launching the national Air Quality Index (AQI), which had its share of teething problems, the Union environment minister Prakash Javadekar on Wednesday announced the release of a daily air quality bulletin for 11 cities, including Delhi, based on prominent pollutants. He also said the Centre would launch its "fresh air as birthright" awareness campaign from 20 cities across the country in June.

"The index, showing air quality in these cities, is based on a quite comprehensive and robust system of data collection at different monitoring stations. It shows overall air quality of a particular city", said Javadekar in an interview to the TOI.

Indian Railways trials solar-powered trains to help cut pollution By Rakesh Rajan Published: 22:04 GMT, 1 June 2015

Indian Railways is soon going to materialize its ambitious plan of harnessing solar energy to run trains. The prototype of the solar power-enabled coach is undergoing trials, and soon the entire train will be fitted with solar panels, officials said. Solar power will significantly bring down diesel consumption; it will also prove to be cost-effective. At present, nearly 17 units of electricity are being generated from the solar power enabled coach.

Innovative waste disposal plant will generate electricity By Shivani Azad, TNN | 15 June, 2015, 09.50PM IST

Dehradun: Uttarakhand is coming up with India's first project to produce electricity from non-segregated waste. Using an innovative German technology called gasification; a conservatively estimated 500 metric tons of waste will produce 25 megawatt of electricity every day. Even better, there will be no emission, landfill or other waste from the process. Under the gasification technology, mixed waste will be treated at ultra-high temperature in the absence of oxygen to produce a synthetic gas that will be used further for production of electricity.

BMC encourages segregation of garbage at source By Richa Pinto, TNN | 15 June, 2015, 10.08PM IST

Mumbai: The Municipal Corporation of Greater Mumbai has decided to encourage segregation of waste at source in local areas through Advance Locality Management (ALMs) and neighborhood groups. Therefore they have appealed all ALMs to support this initiative and encourage segregation of dry and wet waste at source.

ENVIRONMENTAL QUOTE

“Our environment, the world in which we live and work, is a mirror of our attitudes and expectations”.

- Earl Nightingale
As a part of joint declaration of intent to promote the Best Available Techniques between UBA & GPCB in cooperation with GIZ, Germany and GCPC. In a meeting the working group genuinely discussed on reference document of pulp and paper sector from 13-15, April, 2015 at Vapi. Under this GPCB, GIZ and GCPC jointly organized a one day workshop on Environmental Friendly Techniques for Pulp and Paper Sector, at VIA Conference Hall, Vapi on 16th April, 2015. The objective of this workshop was to exchange information on best available techniques catering to the environmental management and pollution control needs for different industrial sectors. The paper mill associations and individual paper industries from Vapi participated in the workshop. The objective behind workshop was to generate motivation for industrial institution towards implementation of Best Available Techniques for industrial process and similar activities.

GPCB & GIZ in cooperation with GCPC organized a One Day Workshop on Environmental Friendly Techniques for Textile Sector, at SGTPA, Surat on 21st April, 2015 under the joint declaration of intent for promotion of Best Available Techniques between UBA & GPCB in cooperation with GIZ, Germany and GCPC. The objective of this workshop was to exchange information and make industries aware about best available techniques and its benefits including awareness on pollution prevention. Participants from various textile mill associations and individual mills participated actively in this workshop with motto of implementation of Best Available Techniques in their industry.

Gujarat Cleaner Production Centre- ENVIS Centre, celebrated “World Earth Day” 2015. Mr. Heer Desai, Project Assistant, GCPC, made a theme based presentation, “Water a Wonderful World” by UNEP. Under the guidance of Dr. Bharat Jain, Member Secretary (ENVIS Coordinator) Gujarat Cleaner Production Centre. The team took pledge together to preserve earth, save water and other natural resources in their day to day life. The team took pledge to promote Cleaner Production and Cleaner Technologies at industrial and institutional level as much as possible which ultimately leads to pollution prevention and waste minimization for overall environmental improvement.
specifically related to Pharmaceutical Sector. Dignitaries from Industries Association and Individual firms proactively participated in this workshop.

**TECHNICAL DISCUSSION AND MEETING BETWEEN GPCB, UBA, GIZ AND GCPC AT GPCB CONFERENCE ROOM, GANDHINAGAR**

**27th April, 2015**

Senior officials from GPCB, UBA, GIZ and GCPC had conducted a technical meeting at GPCB board room, Gandhinagar regarding preparation and development of BREF documents for textiles and pulp and paper sectors for implementation at industrial level which ultimately leads to overall environmental improvement at industrial level.

**TRAINING WORKSHOP ON BHUVAN PORTAL, HELD AT DA-IICT, GANDHINAGAR**

**8th May, 2015**

DA-IICT organized a training workshop on Bhuvan Portal on 8th May 2015. ENVIS Centers from Gujarat Participated in the workshop. The training session continued with presentations on Overview of Bhuvan Portal and its applications including Disaster Management Support by senior officials from National Remote Sensing Centre. GCPC team proactively participated in the training workshop. The session concluded with discussion by GCPC team and experts on Bhuvan Portal on how to promote cleaner production in database through Bhuvan Portal.

**CLEANER PRODUCTION PROMOTIONAL PROGRAMME, HELD AT INDUSTRIAL ESTATE**

GCPC in cooperation with GPCB organized a cleaner production promotional programme in Odhav industrial estate on 19th May 2015. The objective of the programme was to advocate and motivate industrialist with the concept, applications and benefits of cleaner production for acquiring environmental improvement.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Industrial Estate</th>
<th>Date</th>
<th>No. of Participants</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Odhav Industrial Estate</td>
<td>19th May 2015</td>
<td>25</td>
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**CELEBRATION OF WORLD ENVIRONMENT DAY: 2015 HELD AT GCPC CONFERENCE ROOM, GANDHINAGAR**

**5th June, 2015**

The World Environment Day is celebrated each year on 5th June, with a view to encourage global awareness on environment through public participation, for sustainable and equitable development. On the occasion of “World Environment Day 2015”, GCPC-ENVIS conducted a seminar, at GCPC conference room inviting senior officials from GIDC and GIDB. Ms. Divya Namboothiri, Information Officer, ENVIS made a detailed presentation based on the theme “Seven Billion Dreams One Planet”. She elaborated the topic and gave glimpse of current environmental situation and need for resource consumption. The session concluded with vote of thanks from Dr. Bharat Jain, Member Secretary, GCPC (ENVIS Coordinator) speaking on the occasion he requested the staff to save natural resources and to spread awareness towards environmental preservation in their day to day life through tree plantation activity, water conservation etc. He bestowed the glimpse of environmental conservation by saying a famous line from Shreemad Bhagwad Geeta.

_"O pure Earth, May that we utilize your soil well, without causing you injury or harm or disturbing any vital element in you"._
Did you know? RECYCLING SAVES ENERGY

Every time a new product is made from raw materials, large amounts of energy are consumed; recycling decreases the amount of energy it takes to produce these items. Energy is used in the 4 stages of product development:
- Extraction of raw materials
- Manufacture of raw materials into products
- Products used by consumers
- Product disposal

Energy plays a vital role in all 4 stages! Knock out one of these steps by recycling and you’ve saved energy. Using recycled scraps to make aluminum cans uses 95% less energy than making cans from raw materials. It takes 75% less energy to make recycled steel than steel produced from raw materials.

Recycling uses less energy so fewer fossil fuels are burned, which reduces CO2 in the atmosphere and decreases greenhouse gases which ultimately decreases global warming.

Overview of Dyes and Dye Intermediate Sector

Dyestuff sector is one of the core chemical industries in India. It is also the second highest export segment in chemical industry. The Indian dyestuff industry is made up of about 1,000 small scale units and 50 large organized units, who produce around 1,30,000 tones of dyestuff. Maharashtra and Gujarat account for 90% of dyestuff production in India due to the availability of raw materials and dominance of textile industry in this sector. The major users of dyes in India are textiles, paper, plastics, printing ink and foodstuffs. The textiles sector consumes around 80% of the total production due to high demand for polyester and cotton globally. Globally the dyestuff industry has seen an impressive growth. Initially the industry's production bases were mostly in the west, but in the last few years, they have been shifting to the East. Dyestuff can be used for Printing inks, plastics, textiles, paper and foodstuff. The world consumption for dyestuff accounts for printing inks at 40%, paints 30%, plastics 20% and others from segments like textiles.

At present, India contributes about 6% of the share in the global market with a CAGR of more than 15% in the last decade. The dye markets are mostly dominated by reactive and disperse dyes. The demand for reactive and disperse dyes is expected to grow in future as these two dyes are dominant in all the regions. The demand for reactive and disperse dyes are common in all the regions whereas disperse vat and other dyes are stagnant. In the Asian region, China, Korea and Taiwan are strong players in disperse dyes, while India leads in the production of reactive dyes due to an availability of intermediate vinyl sulphone in the country.
**BEE Star Rating for Buildings**

An initiative to promote energy efficiency in buildings

The last couple of decades have seen a significant increase in the share of the service sector on the Indian economy leading to an ever increasing demand for office space. Modern office buildings cater to higher quality working standards essential for sectors like information technology, financial services etc., for attracting customers as well as employees. However the energy performance index (EPI) of such spaces in India ranges from 200 to 400 kWh/sq m/year whereas similar buildings in developed nations have an EPI of less than 150 kWh/sq m/year.

The importance and need for energy efficiency has been growing among the government, corporate and individual consumers in India. Apart from an urge to develop a sustainable environment, the need to reduce the cost of energy has also been a motivator for the various stakeholders. It has been estimated that globally building activities contribute 50 percent of air pollution, 42 percent of green house gases, 50 percent of overall water pollution, 48 percent of all solid wastes and 50 percent of all chlorofluorocarbons (CFCs) to the environment which is vindicating the concern.

In order to enable rapid transformation towards energy efficiency in buildings, policies and measures that create a ‘supply push’, such as codes and standards need to be supplemented by policies and measures that simultaneously create a ‘demand pull’ as well. This ‘demand pull’ attracts building users towards energy efficient buildings, and thus creates a preferential market demand. On the ‘supply push’ side, BEE has developed the Star Rating programme for buildings which is based on the actual performance of a building in terms of its specific energy usage in kwh/sq m/year. This programme rates office buildings on a 1-5 Star scale, with 5 Star labelled buildings being the most efficient. The scheme is propagated on a voluntary basis and the label provided under it is applicable for a period of 5 years from the date of issue. The Star Rating programme provides public recognition to energy efficient buildings, and creates a ‘demand side’ pull for such buildings. Various categories of buildings such as office buildings (day use and business process outsourcing (BPOs), shopping malls, hotels, hospitals and IT parks in the five climatic zones of the country have been identified under the scheme. The rating normalizes for operational characteristics that define the building use, hours of operation, climatic zone and conditioned space. Further to provide a useful benchmark the rating also provides a meaningful comparison to the building’s peer group representing those buildings that have the same primary business function, and operating characteristics. It is important that the rating be based on an analysis of national data that accurately reflects the distribution of energy use for each building type. The national energy performance rating is a type of external benchmark that helps energy managers to assess how efficiently their buildings use energy, relative to similar buildings nationwide. Additionally, building owners and managers can use the performance ratings to help identify buildings that offer the best opportunity for improvement and recognition.

“In a developing economy like India improved energy efficiency is a primary goal which could be achieved through promotion of higher performance standards in buildings”.

CLEANER PRODUCTION & TECHNOLOGY
Ms. Brigitte Zietlow, UBA explaining the purpose of preparing BAT documents at SGTPA, Surat

Ms. Almut Reichart, UBA explaining the importance and benefits of using Environmental Friendly Techniques at Industrial Level at VIA Conference Hall, Vapi

Shri P.R. Rathod, Sr. Project Engineer, GCPC participated in the Workshop on Environmental Friendly Techniques for Textile Sector at SGTPA, Surat

Shri Heer Desai, Project Assistant, GCPC making theme based presentation at GCPC Conference Room on World Earth Day 2015
Dr. K.U. Mistry, Chairman, GPCB discussing with Senior Officials from GIZ, UBA, GIZ and GCPC at GPCB Conference Room, Gandhinagar

Shri Hiren Bhendwal, Sr. Project Engineer, GCPC interacting with industrial technocrats in Cleaner Production Promotion Programme at Odhav Industrial Estate

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Mr. Punamchandra Rathod, Programme Officer, ENVIS  
Ms. Priyanka Joshi, Information Officer, ENVIS  
Mr. Heer Desai, Project Assistant, GCPC-ENVIS

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