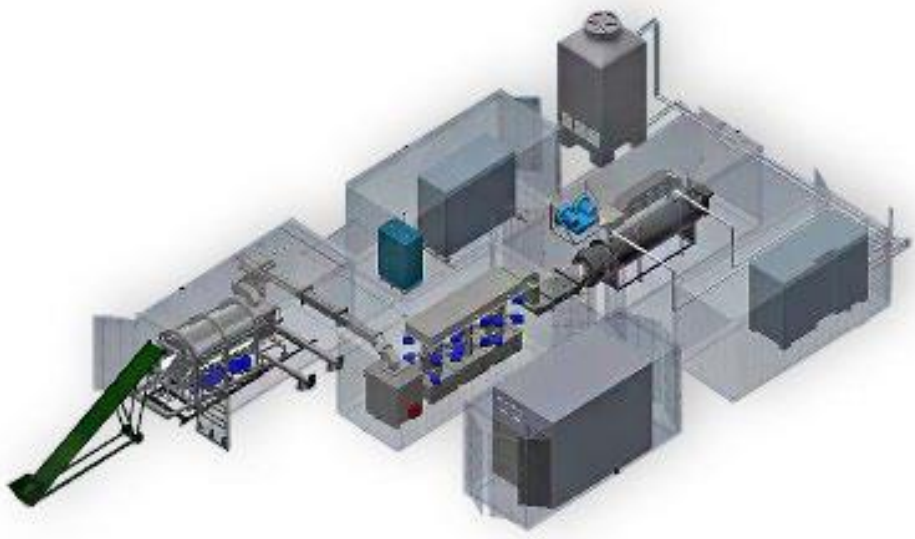
Daytona
Together for quality

We make waste disappear



ATON technical solutions
Comparison of waste disposal methods

ATON technical solutions and innovative approaches are protected by patent applications

Disposal of asbestos containing materials

Patent application number – P377957 (Patent Office of the Republic of Poland), PCT/PL2006/000075 (World Intellectual Property Organization (WIPO) in Geneva)

Disposal of asbestos-containing materials, and the device designed for the disposal of asbestos-containing materials are intended primarily for the disposal of the dismantled building components, especially asbestos-cement plates and the so-called soft materials (insulations containing asbestos fibres).

This method consists in an intensive warming-up of asbestos-containing materials to convert fibrous, crystal structure of asbestos into fibre-free structure.

The process is characterized in that the treated material is crushed and then the crushed material is transported to the microwave reactor; while crushing and/or transportation, the particles of the material are mixed with an agent, which supports their heating. After entering into the reactor the particles of the material mixed with a supporting agent are heated up to the temperature of structural transformation through the action of many polarized beams of the concentrated electromagnetic radiation in the microwave band with frequency of 300MHz-3000MHz. The product of the heat treatment is then removed from the reactor, cooled down and is subjected to final crushing. Reactors based on this technology are installed in mobile containers.

Competitive methods

1. Plasma method (France) – Plasma method for the neutralization of asbestos waste is several times more expensive, compared to other technologies, and therefore its application is economically not justified.
2. Chemical digestion methods – this method is not a significant competition, because other chemical waste is created after this process.
3. Solidification – a temporary solution, because it does not destroy asbestos fibres; furthermore, after some time, the binder may disintegrate – a method virtually abandoned.
4. Storage – Depositing in a landfill is a cheap method but it is related to the construction of new landfills and a huge public resistance. This is the most commonly used method.
5. Thermal remineralisation – an expensive, inefficient method which leaves waste.

Advantages of the ATON

1. The process is effective for both the disposal of asbestos in fibre cement cladding boards, as well as in the case of soft waste with different composition.
2. As a result of microwave heat treatment, a material, which can be used for example in cement mixtures (for renovation of roads, production of concrete elements, etc.) is obtained. Therefore, it is a waste-free technology.
3. Thanks to the installation of the devices in mobile containers the technology can be used at the site where the waste is present. This eliminates costly transportation.
4. The cost of the disposal of asbestos is competitive compared to other known disposal methods and also in relation to the processes of the storage in properly prepared separate landfills.

The technology of the disposal of asbestos-containing materials uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075) and MOS (P-384958)

Disposal of contaminated gases

Patent application number – P-384957

ATON is an invention, which relates to the method of thermal disposal of contaminated gases, particularly waste gases contaminated with asbestos fibrils entering into the air during works associated with the treatment of asbestos-containing materials. This method is also used in the disposal of hazardous PCB compounds (polychlorinated biphenyls), which are contained in waste oils, pesticides, for the neutralisation of very persistent hazardous gases from some manufacturing processes, etc. It is also suitable for the disposal of hazardous exhaust gases from chemical reactions which take place in the areas with high temperatures (300-1100°C). Furthermore, the present invention relates to a device for thermal disposal of contaminated gases.

Disposal of combat and police gases

Another technological process is the method of the disposal of hazardous military gases and gases used by police forces. The composition of these gases is very diverse there are no known universal technologies for their disposal. We have developed a method using ATON MOS reactors and chlorine absorbing chemical reactors – which makes it possible to thermally decompose the hazardous substances, oxidize flammable ingredients and absorb chlorine. This system has been tested in the field conditions (at a testing ground). Very good results, which show the overall efficiency of the method, have been achieved.

Competitive methods

There are no other known methods of disposing gases with diversified chemical composition in an effective and relatively economical way.

Afterburning of pollutants in exhaust gases

Patent application number – P-384958

The invention relates to devices for afterburning of pollutants in exhaust gases. It is also used for afterburning of exhaust gases from furnaces, incinerators, thermal processing equipment for certain substances, from paint shops, arduous odour-emitting plants and other sources that emit polluted exhaust gases.

The developed ATON MOS reactors are simple in construction devices for afterburning of pollutants in exhaust gases from industrial installations; they are free from the faults of the known devices based on the method of afterburning of pollutants by using extra gas or oil burners. The MOS device for the afterburning of pollutants in exhaust gases contains a reactor in the form of a container with a porous material bed, an inlet and outlet for exhaust gases and at least one microwave emitter connected to the microwave generator, and such reactor is connected to a heat exchanger. The device is filled with bed in the form of hot ceramic profiles, with the temperature of 1000-1500°C. The reactor has a multi-layer heat insulation made from material with low radiation absorption.

Thanks to their versatility, MOS reactors are used virtually in all ATON technological processes described herein below.

Competitive methods

1. Additional afterburning chambers with one or more extra gas burners for additional reheating the purified gases are the most commonly used.
2. Application of the expensive ceramic catalysts containing rare earth metals.

Both of these methods, however, have a number of restrictions and drawbacks. Among other things, they require the additional use of the sophisticated dust-collection systems.

Competitive solutions – patents

In the Polish patent PL 165728 there is known a device for removing acidic contaminants from industrial waste gases while using accelerated electron beams and microwave energy; it is characterized in that apart from bringing the electron beam, the device is powered by a stream of microwave energy. By bringing pulses of microwave energy with a frequency of 200 to 10,000 MHz into the area of the reaction chamber using a waveguide located in the side wall of the reaction chamber in a plane perpendicular to the plane of the stream of the accelerated electrons the increase in the number of free electrons in this area is obtained.

In the Polish patent GB 168160 there is a known method of the pyrolysis of waste that is not heated under the influence of microwave radiation; it consists in: (a) contacting waste in the atmosphere, which essentially prevents from the formation of a flame, with a layer of powdered carbon material, which is suitable for heating using microwave radiation, and (b) heating the powdered material using microwave radiation in such a way that heat energy is transferred from the powdered material to the waste to cause the pyrolysis of waste; the waste is delivered to the upper layer of the powdered material so that waste soaks through this layer, and is subjected to pyrolysis in this layer.

In the U.S. patent US 6 015 540 (SRMcAdams et al.) there is also known a device for thermal reactions in the bed of chemically inert, porous material, comprising: a vessel containing a bed, one or more feeding pipes, preferably externally insulated in the part, which passes through the vessel, an outlet, and fills in the form of internal heating elements for warming up the bed.

Advantages of the ATON

1. The known devices do not provide a sufficiently effective and quick afterburning of pollutants in exhaust gases from industrial installations. They are expensive and/or have a complicated construction.
2. MOS reactors are installed in standard containers and can be positioned directly by furnaces, incineration plants or other devices, which produce fumes.
3. MOS reactors are used in virtually all devices developed by ATON designed for thermal neutralization of waste, and they may also serve as the equipment of other existing installations that emit noxious gases.
4. MOS reactors are able to remove arduous odours generated in various industrial processes, such as paint shops, in the production of many chemicals, in the food industry, etc. An example would be a very effective application of the MOS reactors in the installations for the asphalt production (TOTAL . Other known gas treatment technologies lack these opportunities of applications.

This exhaust gas oxidation technology uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075) and MOS (P-384958).

Disposal of organic waste: medical, catering, veterinary

Patent application number – P-389497 (Patent Office of the Republic of Poland), PCT/PL2010/000111 (World Intellectual Property Organization (WIPO) in Geneva)

This method served as a basis for the development of ATON BW reactors – transportable devices for the disposal of organic waste, particularly medical, catering and veterinary waste, equipped with heat recovery appliances. In technologies using this solution usually an assembly of a microwave reactor for

“atonising” with a gas afterburning reactor is compiled. An important feature of the devices developed on the basis of the patented method is the possibility of the assembly of the complete devices inside standard containers and positioning these devices near the place of waste "production".

Medical waste disposal

For the process of medical waste disposal, based on the technology which uses organic waste disposal method in accordance with the patent application (P-389497) ATON BW reactor has been developed – a mobile device for disposing of organic waste, particularly medical, catering and veterinary waste. This device is fitted with an atonising unit (a chamber), into which microwave energy is brought and it is characterized in that at the outlet the atonising reactor unit is connected to a gas afterburning reactor. All of these devices are placed in a mobile container.

The process involves the following steps: loading of waste containers (bags), grinding the waste and transporting them to the atonising chamber, where the complete gasification of organic materials in high temperature takes place and the gases are taken into the MOS reactor, where all combustible gas components are effectively oxidized. The stream of hot gases, after their purification in the MOS reactor, is directed to heat exchangers where e.g. water is heated, which can be then supplied to the hospital.

Competitive methods

1. Combustion – A method, in which there is a significant emission of hazardous substances into the atmosphere, including dioxins and furans.
2. Sterilization of medical waste using microwaves – this method is not allowed in Poland. No significant reduction in weight and volume of the treated material.
3. Sterilization in an autoclave – this method is not allowed in Poland. No significant reduction in weight and volume of the treated material.

Competitive solutions – patents

In Chinese patent CN2877705 Y (published on 14 March 2007) there is a known vehicle for disposal of hazardous substances with infectious diseases, fitted with a combustion unit used for sterilizing the waste and a device for taking in wastewater and its treatment fitted with electric power supply system, connected in an assembly. The sterilizing device generates high-pressure steam using combustion heat and has a twin-chamber design. The vehicle is fully functional while driving and can be a used as a rescue unit in the event of an epidemic.

In the Japanese Patent JP10019223 A (published 23 January 1998) there is a known burning assembly comprising a device for feeding the waste, an exhaust fan, a rotary kiln, etc., and an auxiliary processing unit for exhaust and flue gases fitted with an auxiliary combustion device, a dust receiver, an exhaust fan, etc. These units are installed on mobile frames connected with the base and joined with each other using only a gas pipe. They can be installed on site and are suitable for transport using containers.

Japanese patent JP3241217 (published 28 October 1991) describes a vehicle for waste incineration with an automatic loading device for loading the burned material and an automatic device for removing slag. After feeding the material into the combustion chamber using an automatic loading device, it is burned in the twin combustion chamber using two burners, and its remains are transferred to an automatic slag-removing device.

In the U.S. patent US2006219139 A1 (published 5 May 2006) there is a known mobile system consisting of a container, at least one gasification chamber and a combustion chamber for generated flammable gas; this system can include a control room. The waste is loaded into a suspended mesh cage, which is distant from the walls of the gasification chamber. The produced flammable gases are extracted from the

gasification chamber into the combustion chamber of the produced combustible gas. The combustion chamber may include a labyrinth-type ignition chamber used for neutralization of the generated flammable gases.

The known mobile equipment for the disposal of organic waste, particularly medical waste, are expensive vehicles, which cannot be left unattended, or complicated and expensive combustion units assembled only on site. The known combustion systems use the gas or induction heating, which is uneconomical. The known container systems are not suitable for the disposal of hazardous medical waste. The main disadvantage of the described competitive solutions is the lack of an effective method for the purifying of exhaust gases emitted as a result of the heat treatment of waste. This disadvantage is not present in the technology developed and implemented by ATON-HT.

Advantages of the ATON

1. In the reactors constructed according to the ATON technology exhaust gases are very effectively purified and meet all EU standards.
2. Post-process product in atonising are high-calorie gases and a small amount of solid fraction consisting of carbon and mineral substances; in the case of conventional methods the decomposition results in the formation of: charcoal, wood gas, distillate, water, primary wood tar.
3. The solution is the most universal: virtually any organic waste can be disposed of.
4. The volume (and weight) reduction of waste is the greatest (80%-96%).
5. The recovered energy can be used, for example, for heating water.
6. Devices based on the implemented method are installed inside a container and positioned near the source of waste which eliminates the need for the transportation of waste (and incurring the costs of transport).

The technology of the disposal of medical waste uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075) MOS (P-384958), ATONIZACJA (P-389497) and dechlorination (patent application in preparation).

Gas heat treatment at high temperatures

Thermal treatment of waste containing chlorine compounds in its composition requires the use of special methods, which effectively absorb this element or which fix chlorine in safe chemical compounds or solutions. Examples are the processes of thermal decomposition of waste containing PCBs (polychlorinated biphenyls), hospital waste, plastic waste, etc.

We have developed an effective method of the chemical fixing of chlorine and its compounds in the gaseous state in a specially designed chemical reactor. A significant feature of this method includes carrying out a chemical reaction in hot gases (at approx. 400°C) and obtaining a safe substance containing fixed chlorine – sal ammoniac. The process of absorbing chlorine can be fully automated through the automatic dosing of reagents, and as confirmed by tests, it is effective for a wide range of concentrations of chlorine in gases (from fractions of a percent to tens percent).

Many technologies of the disposal of asbestos waste assume the use of the developed chemical reactor design for fixing chlorine in optimally selected segments of technological devices so that chlorine and its compounds could not encourage the formation of dangerous substances in these devices and cause corrosion of the construction components. This reactor can come in the form of a separate device with

suitable connections for gases containing chlorine and outtake for purified gases – which determines the universality and simplicity of the application of this method of gas dechlorination.

Purification of dielectric materials (sands) from organic and petroleum pollutants and PCB

The purification process of dielectric materials of various types of organic pollutants, oil pollutants and other dangerous substances (including PCBs) has been effectively solved in an innovative technology, which uses the previously developed ATON HR, ATON MOS reactors and the recently implemented chemical reactors for "capturing" of chlorine. This technology is implemented in several stages: contaminated sands are fed into the pre-heater, where they are heated to the temperature of approx. 400^{o}C using conventional gas burners. As a result of this high temperature, the decomposition of substances containing chlorine and the release of chlorine along with steam and other volatile components takes place. These gases are fed into a special chemical reactor, in which the chemical fixing of chlorine takes place (as a result of synthesis sal ammoniac). Then, after purification from chlorine the material is fed into the reactor ATON HR, where full afterburning (oxidation) of pollutants in the sand takes place. The purified sand is poured from the rotary drum of the HR reactor, while the released pyrolysis gases are directed into the MOS reactor, where their effective purification is carried out. These gases are then routed to a heat exchanger, in which they are cooled down. At the same time, the significant quantities of energy are recovered; this energy can for example be used to heat water, generate hot industrial steam, and even at a fairly large-scale process – to produce electricity.

Competitive methods

1. Bacteria – a method, which use bacteria that decompose petroleum substances. Disadvantage of the method – a very slow process (taking many years), low efficiency.

Competitive solutions – patents

European patent EP 1311791 (S. Novak) is a basis for the constructions implemented by EnviroWave Corp. This solution is the most similar to the ATON technology.

Advantages of the ATON

1. The technology of ATON enables an effective purification of sands or dielectric materials with very different composition. For example, it has already been used for the removal of oil pollutants, the removal of resins from worked foundry cores, oil pollutants from alundum ceramic and in other similar processes. None of the known methods has such a wide range of applications.
2. ATON's technology is very effective in removing contaminants pollutants containing chlorine compounds (e.g. PCB). In this case, it is only necessary to insert a chlorine-fixing chemical reactor into the device.
3. The purification process is continuous and can be fully automated.
4. Devices are installed inside standard containers, which makes it possible to place the reactor near the contamination and carry out the process without the need to transport the contaminated soil.
5. Usually, the process is completely waste-free - pure sand pours out of the reactor and chlorine is fixed in a safe chemical compound of sal ammoniac, which has other applications.
6. Exhaust gases are purified (they meet all standards required by the EU) and can be used for example to heat water to produce steam or generate electricity.

Technology for the purification of dielectric materials (sand) from organic pollutants uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075) and MOS (P-384958) and the method of “capturing” chlorine according to the prepared patent application.

Tyre processing with the production of electricity

The technology involves the use of previously developed methods and approaches (partly protected by patent applications) – the method of the disposal of organic waste, the gas purification method and the method of "capturing" of chlorine from hot gases. In this technology shredded tyres are placed in the ATON-HR reactor, in which microwave energy heats them to high temperatures (above 800^{o}C), which results in the complete gasification of the material. Then, after passing through a chemical reactor, which absorbs chlorine (the use of this reactor will be necessary only in case of sufficiently large concentrations of chlorine), hot gases are sent directly to the engine coupled to power generator. It is important here, that part of the gas stream from the reactor HR is not directed into the engine and exhaust gases from the engine are fed into the MOS reactor for their complete purification. Thus, a unique and effective system is created, which makes it possible to generate electricity and hot purified gases without a risk of the emission of the pollutants in the released gases (including the exhaust gases from the engine). Purified hot gases can be successfully used for drying sewage sludge or in other processes that require energy input.

Competitive methods

1. Incineration of shredded tyres in an incineration plants (mainly in cement kilns) – the most popular method. Disadvantages of the method: pollution of furnaces and environment by the emissions of sulphur compounds and large emissions of CO2 (carbon dioxide).
2. Small amounts of shredded rubber from tyres are used in the production of paving stones and other similar products.
3. Microwave method - competitive method developed in the company EnviroWaVE Corp. in Fredericktown (USA) is known. In this method, as in the ATON technology, microwaves are used for controlled heating of shredded tyres. Shredded tyres are brought into the process chamber, where they are heated by microwaves to degas all volatile components. The process is periodic – after loading the batch of material the chamber is closed and microwaves are applied; after the heating is over microwaves are turned off, the material cooled down and the chamber is opened. This has impact on poor performance of the device. In addition, this process is conducted in a nitrogen atmosphere to eliminate the ignition of pisolitic gas mixtures in the presence of oxygen. Since there are large amounts of sulphur and usually small amounts of chlorine the material used in tyre production – the installation is equipped with a scrubber. Therefore, it is required to additionally dispose of the solutions containing compounds of sulphur and chlorine. Moreover, the presence of chlorine compounds inside the process chamber may cause strong corrosion of the metal walls of the chamber.

Competitive solutions - patents:

European patent EP 1311791 (S. Novak) is a basis for the constructions implemented by EnviroWave Corp. This solution is the most similar to the technology implemented at ATON.

Advantages of the ATON

1. The process is carried out continuously. This helps increase the efficiency of the method and significantly reduce energy inputs.
2. Energy efficient process.

3. The ATON method through the heating of the material in a drum reactor to the temperature of approx. 800ºC there are no liquid fractions – only gas is emitted which is used directly to power the engine of the power generator.
4. The ATON method uses a pre-heater, where water is evaporated, and (most importantly) chlorine is separated, which is then absorbed and fixed in an additional chemical reactor. Thus, the effect of the strong corrosion of parts in the microwave reactor and heat exchangers is eliminated.
5. The fixing of chlorine is performed by the "hot" method at the temperature slightly above 400°C – there is no need to cool down the gases containing chlorine and then re-heat them.
6. Gases released in the process inside the ceramic drum have the temperature of over 400-500ºC and, after they are slightly cooled down, they are directed into the engine. This is possible because chlorine has been previously absorbed.

Tyre processing technology with the production of electricity uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075), MOS (P-384958), ATONIZACJA (P-389497) and dechlorination.

Sewage sludge disposal technology

Developed method of the disposal of organic waste is used as an element of the developed of the sewage sludge disposal technology. In this technology sewage sludge (e.g. municipal waste) is mechanically pre-dried (in centrifuges and presses), then dried in fluidised bed dryers, after which the dried material with a moisture content of 10-20% is fed to the ATON HR reactor. In the ATON HR reactor the dried sludge is subjected to complete oxidation. Gases, which are emitted here are directed into the ATON MOS reactor, where they are properly afterburned. The stream of hot gases from the MOS reactor is then used as an energy source in the dryer. The final product of the process is coal and minerals (the composition depending on the initial composition of the sludge).

Competitive methods

1. A method is known for drying sewage sludge (first mechanically and then in the dryers heated by gas or oil burners) and the use of the dried material in agricultural industry. This method is not widely used because of the reluctance of the adoption of such material by farm owners. Another limiting factor is the danger of heavy metals in sewage sludge. These metals can be leached by water and cause contamination of water intakes.
2. Creating special plantations of fast-growing plants on a bed of dried sewage sludge. The purpose is the absorption of heavy metals by these plants. However, this method has not found wider application.
3. Burning in large incineration plants.

Advantages of the ATON

1. The entire technological process is carried out in the sewage treatment plant (transportation of the sludge is not required). Devices are installed inside standard containers.
2. The "recycling" of the heat obtained at the MOS reactor’s outlet significantly reduces the energy consumption required for drying the sludge. Gas or oil burners in the dryer serve the role of starting and on-duty devices.
3. As a results of the process a very large reduction in weight (and volume) of the final product in relation to the initial mass of sludge is obtained.
4. In the case of municipal sludge, the final product of the process can be used as an additive to fertilizers – which has been confirmed by the analysis of the material’s composition carried out at the University of Life Sciences in Wroclaw.

5. In the case of industrial sewage sludge (containing heavy metals), the final product can be subjected to vitrification directly in the device (after installing an extra segment). Vitrification prevents the leaching of heavy metals from the product of the process.

The sewage sludge processing technology uses the following methods protected by patent applications: MTT (P377957, PCT/PL2006/000075), MOS (P-384958), ATONIZACJA (P-389497) and vitrification (know how)

Explosives production waste neutralization technology

It is a technology developed at the individual request of the explosives manufacturer. The essence of the original technical solution consists in the special combination of two ATON-HR reactors with one ATON MOS reactor and the feeding of liquid waste with a carrier (sand, special sorbent). After the thermal degradation of the neutralized substance the carrier is returned and reused. Gases released from both ATON HR reactors are directed to the ATON MOS reactor, where they are afterburned.

It is an innovative technology that is not patented for in regard of a specific recipient.

Competitive methods

It should be noted that there are no known effective methods of the disposal of this particular type of waste.

Contact us:

Monika Swierc
m.swierc@daytonalubricants.com
m. +48 660 434 120

Krzysztof Hawryszczuk
k.hawryszczuk@daytonalubricants.com
m. +48 796 018 954

Daytona Lubricants Polska Sp. z o.o. Sp. k.
Domaniewska 47, 02-672 Warszawa
NIP PL5213642067, www.daytonalubricants.com