



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Υπουργείο Παιδείας,
Έρευνας και Θρησκευμάτων



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2nd Junior High School of Amaliada
ERASMUS+ PROGRAMME KA 2 STRATEGIC PARTNERSHIP “European Schools Go Green” 2017 - 2020



Erasmus+ programme “European Schools Go Green” 2017 – 2020

3d Year of Collaboration

Galileo Galilei Technical High School of Genova, Italy
2nd Junior High School of Amaliada, Greece
Goethe Gymnasium Kassel, Germany

Renewable Energy Sources – Sustainable Development – Climate change

2ND JUNIOR HIGH SCHOOL OF AMALIADA STUDENTS
INTERVIEW SCIENTIST MRS DESPOINA KOSSYVAKI
FOR OUR “GREEN” MAGAZINE 2020



Mrs Kossyvaki we are very happy and honored to take your interview. After we met you during our amazing tour and visit at the Italian Institute of Technology in Genova, Italy, as part of our Erasmus+ students mobility in 2019, we wanted to take your interview as we admire your research and work so much ! Why did you choose this difficult particular field of studies as a PHD student? Please introduce us to your work, curriculum and yourself!!!



Mrs Kossyvaki is presenting to our students their amazing research results in IIT laboratories in Genova, Italy, during our students Erasmus+ mobility in 2019. This visit inspired the interview idea . Students and teachers were very impressed with all the waste and exciting alternative material uses the scientists are working on.

My name is Despoina Kossyvaki, I am 27 years old and I am currently a PhD student at the University of Genoa, carrying out my research activity in the Italian Institute of Technology (Istituto Italiano di Tecnologia or simply IIT). I concluded my master studies in the School of Environmental Engineering at the Technical University of Crete (Πολυτεχνείο Κρήτης/Politechnio Kritis). Environmental engineering is a very interesting and upcoming field of studies, since it is multidisciplinary department that gives its students the opportunities to obtain knowledge and skills of different scientific sectors, such as hydraulics, physics, mathematics, chemistry, civil engineering, microbiology, renewable sources, wastewater and waste management and treatment, etc. In fact, this was the main reason that I chose to study there. During my studies, I had the opportunity to follow very interesting lectures and – most importantly – attend and take active part in laboratory experiments and design a wastewater treatment plant. I also had the chance to visit the landfill of Chania and Athens, the center of recycle of Athens and the wastewater treatment plant of Psitalia.

During my studies, I participated in the Erasmus mobility program. Specifically, I was accepted from the University of Life Sciences of Prague (Česká zemědělská univerzita v Praze) for an academic semester to attend the lectures and do laboratory activities in the faculties of Environmental Sciences and Agrobiological, Food and Natural Resources. This exquisite experience broadened my horizons not only for my studies but also in a personal level. After writing my experimental thesis in Microbiology («Assessment of microbiological quality of seawater and sand samples in bathing areas in Chania, Greece», available online in <https://dias.library.tuc.gr/view/78975>), I was accepted by the IIT – Center of Convergent Technologies to do an Erasmus+ traineeship mobility, so I made my luggage for Genoa! As soon as I got there, I was impressed by the research group of Smart Materials in which I worked for 3 months, and I asked for an extension of the Erasmus+ mobility, which fortunately was accepted! So, the 3 months became 6, and after one more year of work as a Fellow, always in the group of Smart Materials, I applied for the PhD program of

Bioengineering and Robotics – Curriculum Bionanotechnology of the University of Genoa, always in collaboration with the IIT!

During the Erasmus+ traineeship, I worked in the research line of prevention and healing. During this experience, my colleagues and I fabricated electrospun nanofibers from keratin that we extracted from wool, a synthetic polymer polyvinylpyrrolidone and cinnamon essential oil, to create a scaffold for the delivery of active compounds of cinnamon essential oil for the healing of skin burns. We followed the release kinetics of these compounds from the fibers, while the material was found antioxidant, antibacterial, biocompatible and anti-inflammatory. This work was entitled as **“Keratin-cinnamon essential oil biocomposite fibrous patches for skin burn care”** was recently published in the journal of Materials Advances and you can find it online here <https://pubs.rsc.org/en/content/articlelanding/2020/ma/d0ma00416b#divAbstract>.

What exactly is you are working on at the IIT?

What is the aim of your studies and research there?

Can you describe and present a part of your very interesting research as the results you have showed us in IIT?

As I already mentioned before, I am a PhD student of the University of Genoa, working in IIT in the research group of Smart Materials. The aim of my studies is the development of **“Smart indicators of alterations in the metabolic activity of microorganisms”**.

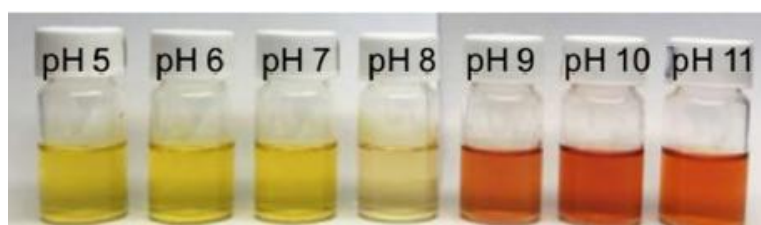
But what is the importance of these indicators? With the worldwide population continuously growing, the increased environmental pollution and the lack of resources, the identification of good quality for food, water and health factors has become extremely important. Among the categories of quality evaluation, the immediate acquisition of information concerning the microbial growth within a specific macro and micro environment, indication of the food spoilage, of non-drinkable water, but also of various skin infections is of emerging importance. Therefore, the need for microbial growth monitoring is essential for modern societies. Since the metabolic activity of microorganisms can alter the pH of the environment in which they live, pH indicators are the number one priority of scientists to cope with this situation. In fact, when the pH indicators are introduced in the environment in which the microorganisms live and multiply, they can provide qualitative or semi-quantitative information through visual colorimetric changes or through comparison with standard references.



Picture 1: The colorimetric behavior of (a) anthocyanin extract from red cabbage and of (b) the material -indicator that contains the anthocyanin extract (J. Zia et al., 2020).

And how can we obtain these colorimetric changes? In my case, I use two molecules: anthocyanins and curcumin. These molecules have the ability to change their color according to the pH (Pictures 1 and 2). Anthocyanins are found in many fruit, vegetables, seeds and flowers, while curcumin is found in the spice called turmeric. By extracting the anthocyanins with the use of water or other solvents containing alcohol and incorporating them or

curcumin in polymeric materials, I aim to obtain materials – indicators that will give information about the state of a food or a wound. For example, when a fish is close to spoilage, the increase of microbial growth leads to the increased release of some amines (such as ammonia) that increase the pH value inside the packaging. If we put the indicator inside a packaging containing the fish, it will trace this pH change and will obtain a different color. With the appropriate labeling that will correlate the color of the indicator to the state of the food, the consumer will be able to know in advance that the fish is close to expire and he will give priority to its cooking.



Picture 2: The colorimetric behavior of curcumin in alkaline pH (Hui-zhi Chen et al., 2020).

In order to better understand this mechanism, you can have a look at the recent publication of my colleague Jasim Zia, who was working with one of my tutors, Despina Fragouli, on this topic. You can find their article with the title “Porous pH natural indicators for acidic and basic vapor sensing” here: <https://www.sciencedirect.com/science/article/pii/S1385894720325018>.

What are the differences you have spotted between Greece and Italy regarding the scientific research and recycling ? Are there European or other countries with exceptional successful system of waste treatment and alternative solutions to replace plastic?

Until last year, Greece was in the 18th position of the (28) countries of the European Union regarding the budget for research and development activities. I am sure that the critical economic situation of our country plays an important and determinant role in this, and due to this, many young scientists are forced to leave Greece in order to pick a career in research without having the opportunity to return to their country and have a satisfying job and income after their experience abroad. Of course, this has an impact also in the development of technologies and until a certain point the way that Greek society is set, from the age of its habitats to the everyday habits, such as the one of recycling.

In fact, there is definitely a difference between Greece and Italy regarding the recycling process. To start with, the first and most obvious difference is in the way of the selection and deposition of the recycling objects. To be more specific, in Greece we have the blue bins for recycling of packaging, where all the recycled materials end up together, while in Italy there is a separation of: (a) paper and carton, (b) glass, (c) plastic and metal. At this point, I would also like to highlight the presence of the brown bins that accept organic waste, something that is very rare to find in Greece. In addition to this, during my travels in various places of Italy, I have noticed differences in the waste treatment. While in Sicily some municipalities do not participate in recycling programs yet, some cities of the north of Italy like Trento have a very strict protocol and better organization, with waste and recycling bins in every block of flats and a specific number of bags that every house can use per year to put their waste! This means that people are somehow “forced” to create less waste. Based on this, I personally believe that everyone – no matter the organization of the country where we live – should always take into consideration and act according to the 4R (Rethink – Reduce –

Reuse – Recycle), which suggests that we should re-define the way of our everyday life in order to create a minimum waste, reducing our waste fingerprint in this planet. However, the countries of central and north Europe have a very good system of waste treatment. A very interesting example is the one of Norway, where they use their waste to produce thermal energy for their heating systems!

What is your opinion about the way that we should use waste and natural materials and resources in the future in Greece? What do you think we should change? And how would you suggest we improve our energy profile?

I strongly believe that many things should change in the way that we use/treat waste and natural materials and resources, especially in Greece. To start with, and always highlighting the 4R, we should start from **rethinking our needs**. A very critical aspect is to investigate what we really need to use. Modern people lead a lifestyle full of products and materials that sometimes they do not really need. If we rethink also in this case, we can certainly **reduce** what we use and put less burden in our wastelands and consequently to our planet. Another very important aspect is to **reduce or even quit single-use items**, replacing them with items made of more environmentally friendly materials such as bamboo, cotton and bioplastics. The main advantage of these items is that are **reusable** and can serve our everyday needs without having a deteriorating environmental impact. For instance, we could replace plastic toothbrushes with ones made from bamboo, single use plastic cups of coffee with refillable ones, we can carry our own cutlery made of bamboo instead of using plastic ones, take always our refillable bottle of water from home etc. These are only a few everyday examples and if we all take some time to think how much plastic (and not only) single use items we use every day just because of habit, we can realize how big is our waste fingerprint. This thought could be used as a starting point to change our habits and as a result our impact on the planet.

Of course, it is not always easy to use reusable items. A good example of this are the packaged goods that we buy from the super markets. In this case, if we have made our research and we realize that we cannot avoid certain products, we can always **recycle** them, always following the indications of the recycling system of the place that we live. The latter is of high importance, since sometimes we do not recycle properly, and what we throw in the recycling bins can end up to the landfills. Especially for Greece, you can find all the information about recycling here: <http://www.dedisa.gr/ble-kadoi/>.



In Greece and especially in Ileia prefecture we have a big problem with waste management and unfortunately we do not recycle as we should. How do you suggest we could make recycling the rule and not the exception in our everyday lives ?

Until recently, the recycling process was something that Greek people were ignoring. During the last years, the Greek state provided citizens with the blue bins, where they can recycle packaging made of paper and carton, plastic and aluminum. Unfortunately, though, there is a remarkable score of people, mainly older ones, who have not introduced recycling in their lives. I believe that in order to make recycling the rule and not the exception in our everyday lives, people should start learning about it from a very young age. The first step should be for the parents to be the good example, by not only recycling at home, but also talking to their children about the importance of it and motivating them to do so. After that, schools should be succors of this effort by introducing courses about environmental consciousness and behavior, including recycling as one of the most important everyday habits that students should develop and maintain. Another important thing that should be introduced in the education system should be excursions to landfills and recycling centers, since in this way all youngsters could see how waste is treated and realize how big are the amounts of trash that we dispose every day!

At the same time, the state should organize better the recycling procedure, by making easier the access to the blue bins for all of the citizens, no matter how remote is the area that they live. The next step for the municipalities should be to include separate recycling bins for the various materials (paper, carton, glass, aluminum and plastic), in order to make the recycling procedure easier even before the step of waste collection and of course, to encourage the awareness of what we consume. In this way, people would realize what materials they dispose the most and be stimulated to rethink their waste and why not change their consuming habits. Last but not least, more strict controls should be carried out by the authorities, in order to monitor and ensure the proper disposal of waste and recyclable materials and verify the effectiveness of the recycling procedure.

How can you picture for us the effects and contribution of your research to sustainability and biodiversity protection?

Is it possible that industry can agree with the wide use of ecological alternative materials?

The research of the group of Smart Materials deals with the development of new materials combining various polymers and changing their properties by introducing nanofillers or organic molecules in the matrices. We work on both the control of the chemistry and of the structure of the materials we develop, in order to achieve precise properties adjusted to the needs of various application fields. Since polymers are the main building blocks of the materials we fabricate, we have intensified our efforts in using natural polymers principally of plant origin (silk, keratin, zein, starch, alginate, chitosan etc.) or biodegradable polymers, in order to develop new advanced composite materials with accurately modulated properties but at the same time with minimal environmental impact.

The pillars of our group are mainly the ones of sustainable biocomposites, food protection, biomedical devices, water protection and green flexible electronics*. Sustainability is one of the main priorities of our group, since we aim to develop materials that can substitute some of the already commercialized products – mainly based on plastic – that pollute the environment. We already collaborate with various companies and some of the developed materials are already patented and/or commercialized. Imagine that some of the materials that we produce come from the waste of the companies themselves, with a great example the one of fruit and vegetable packaging that is fabricated from fruit and vegetable waste*. This is something that gives me hope and optimism about the future, since with these alternative materials we can minimize our fingerprint on Earth and protect its biodiversity.

I believe that if industries include to their politics the research and development of such products, the conventional ones that we currently use can be substituted and there can

be massive use of ecological alternative materials that do not have a bad impact to the planet.



ISTITUTO ITALIANO
DI TECNOLOGIA

**For more information about the group's action, visit the following links:*

<https://www.youtube.com/watch?v=shWj4w8wSG4&>

<https://www.youtube.com/watch?v=5XlQR08ixjA>

<https://www.youtube.com/watch?v=9ND84TmXfzI>

<https://www.youtube.com/watch?v=A6Q9RGd6iM4>

<https://www.youtube.com/watch?v=3Ys7sMlvpz8>

Which way do you propose the state should work to limit human hyperactivity and hyperconsumption, which consist threats to the young people's future and destroys our environment?

In my opinion, hyperactivity and overconsumption is mostly a matter of personal education. Specifically for overconsumption, it derives mainly from the self-centrism and the feeling of having unsatisfied needs. For this reason, the families and the educational system should focus on creating not only environmental consciousness but first and foremost a more minimalistic approach to life, bringing children closer to nature and teach them how to be creative and feel good with themselves without having the need of cellphones, tablets and other distractions of this type. By making life simpler, people will have less needs and buy less products, and as a result their impact to the environment will be less destructive.

Do you think that Greek students and their families are informed for the above issues? What could be more included in Greek education to improve climate crisis education or other ways to engage them better? Do European projects as Erasmus+ contribute to environmental awareness, and if so could we improve their role?

As I already mentioned, the awareness of the Greek people regarding these topics is unfortunately inadequate. Nevertheless, I have noticed that during the last few years more and more young people have started rethinking their values, introducing habits such as recycling and leading a more minimalistic way of life. As for the educational system, I finished school in 2011 and until this time, we did not have any course dedicated to the Environment. I hope that in the future schools will be more organized under this aspect. Environmental courses and excursions should be introduced to the students' schedule, promoting behavior and habits that respect the environment and are not destructive to our planet Earth; remember: this planet is not ours; we borrowed it from our children.

The Erasmus+ is one of the most important European programs, since it gives students the opportunity to travel and see for themselves how other states function under certain topics. In this way, young people can broaden their horizons, “put in their luggage” new information, and another point of view that will probably change the way that they see and evaluate their actions and hopefully they will adopt a more environmentally friendly way of life.

One nice suggestion for the reinforcement and improvement of the Erasmus+ program would be to include more visits in industries and research centers, since these places are the “heart” of technological advances and evolution. In this way, students will have the opportunity to see all of the new advancements and get in touch with how science and production works. This can also help them for their future development, since they can be motivated to choose a studying and work path.

Thank you so much Mrs Kossyvakis for your time and support!!! Your work is a great inspiration!!!

The students of 2nd Junior High School of Greece

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<https://blogs.sch.gr/samiamidi/>

https://blogs.sch.gr/samiamidi/?page_id=504

<https://live.etwinning.net/projects/project/140248>