

## Summary report on research accreditation

### I. General information

Name of organization	<b>Institute of Chemistry of the Academy of Sciences of Moldova</b>
Organization type ( <i>to underline</i> )	<u>Research institute</u> Higher education institution    Ministerial research institute
Research direction (s) of organization	1. Chemistry of coordination compounds with various properties; 2. Chemistry of organic biologically active compounds, including natural ones; 3. Physical-chemical processes and mechanisms, methods of analytical control of ecosystems and non-polluting technologies.
Correlation with strategic research direction (s) of activity in the field of science and innovation for 2013-2020	1. Materials, technologies and innovative products; 2. Health and biomedicine.
Evaluated period	<b>2011-2015</b>
Web of organization	<a href="http://www.chem.asm.md">www.chem.asm.md</a>

### II. Research capacity (annual average for evaluated period)

Total number of employees	<b>151.4</b>					
Number of scientific researchers	<b>105.8</b>					
Number of researchers who possess honorific titles, scientific degrees, scientific and scientific-didactical titles	ASM full members	ASM corresp. members	Professor	Associated Professor	Dr.hab.	Dr. (PhD)
	<b>4.6</b>	<b>2</b>	<b>5.8</b>	<b>24.2</b>	<b>14.8</b>	<b>40.2</b>
Number of researchers involved in international projects	European Commission Programmes	United Nations Programmes and Funds		Bilateral Programmes financed from the national budget	Others	
	<b>2.4</b>	<b>0</b>		<b>8</b>	<b>3.6</b>	
Number of young researchers (under 35 years old)	PhD students			Others		
	<b>16.4</b>			<b>11.8</b>		
Financial resources - revenues (thousand MDL)	Public budget			Special means		
	<b>10633.8</b>			<b>2068.1</b>		
Categories of special means (thousand MDL)	National			International		
	<b>1392.1</b>			<b>675.9</b>		
Distribution of expenditures (thousand MDL)	Salary	Procurement of scientific equipment	Traveling for scientific purposes (travel, accommodation, per-diems, etc.)		Other	
	<b>7942.9</b>	<b>891.9</b>	<b>651.6</b>		<b>3169.4</b>	
List of 3 basic research	1. Nuclear Magnetic Resonance spectroscopy;					

methods, equipments, technologies (per accredited field)	<ol style="list-style-type: none"> <li>2. Mossbauer spectroscopy;</li> <li>3. IR and UV-Vis spectroscopies.</li> </ol>
List of provided scientific services	<ol style="list-style-type: none"> <li>1. Determination of metals in the divine, fruit and vegetable juice, wines and wine materials;</li> <li>2. Determination of toxic metals in food.</li> <li>3. Analysis of metals and alloys;</li> <li>4. Determination of toxic organic compounds (pesticides, polychlorinated biphenyls, polyaromatic hydrocarbons, phthalates) in different environmental objects: natural waters; waste waters, soil, sediments, plants, agriculture and food products, waste. Substance and impurities identification by Gas Chromatography with mass detection in different objects.</li> <li>5. Determination of chemical elements (K, Na, Sr, Ca, Mg, As, Se, Hg, Pb, Cd, Cu, Zn, Ni, Cr, Al, Mn, Fe, Ga, Si) in different environmental objects: natural waters (ground, surface, mineral, potable); waste waters, soil, sediments, plants, agriculture and food products, waste.</li> <li>6. Determination of water quality parameters: <math>\text{NO}_3^-</math>, <math>\text{NO}_2^-</math>, <math>\text{NH}_4^+</math>, <math>\text{HCO}_3^-</math>, <math>\text{Cl}^-</math>, <math>\text{SO}_4^{2-}</math>, <math>\text{F}^-</math>, conductivity, pH, dissolved oxygen".</li> <li>7. Elemental analysis by atomic absorption method in vegetal and animal samples;</li> <li>8. Elemental analysis by atomic absorption method in soils, rocks and sediments, glass;</li> <li>9. Measurements of structural parameters;</li> <li>10. Recording of infrared spectra;</li> <li>11. Recording of spectra in ultraviolet and visible regions;</li> <li>12. Recording of Nuclear Magnetic Resonance spectra;</li> <li>13. Elemental analysis: Carbon, Hydrogen, Nitrogen;</li> <li>14. Mass chromatogram Detector.</li> </ol>
List of editorial activities	<p>Founder of the <i>Chemistry Journal of Moldova</i>, ISSN 1857-1727 (print), ISSN 2345-1688 (online) (<a href="http://www.cjm.asm.md/">http://www.cjm.asm.md/</a>).</p> <p>The <i>Chemistry Journal of Moldova</i> has been indexed in Emerging Source Citation Index (ESCI) - a new edition of Web of Science launched by Thomson Reuters - since 2015. Universal Impact Factor 0.135 for year 2014. IBI Factor 3.2 for year 2015, received from InfoBase Index. Journal Quality Factor 1.20 for year 2016. The National Council on Accreditation and Attestation of the Republic of Moldova scientific journals ranking: Category A.</p>

### III. Distribution of the number of research projects and themes during the evaluated period

	2011	2012	2013	2014	2015
ASM institutional projects	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>8</b>
ASM projects in the frame of State Programmes	<b>4</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>2</b>
ASM technological	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>

transfer projects					
ASM projects for equipment procurement	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
ASM projects for young researchers	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>
ASM projects in the frame of bilateral programmes	<b>6</b>	<b>3</b>	<b>5</b>	<b>6</b>	<b>4</b>
International projects/grants	<b>5</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>4</b>
List of 3 representative international projects/grants	<ol style="list-style-type: none"> <li><b>FP7-PEOPLE-2009-IRSES Nr. 246902</b> „<i>Photocatalytic Cluster Complexes for Artificial Photosynthesis Applications</i>”. Project manager: acad. Constantin Turta, 2010-2013.</li> <li><b>FP7-PEOPLE-2013-IRSES Nr. 612484.</b> „<i>NanoBioMat - Biocompatible Materials/Bioactive Nanostructured</i>”. Project manager: cor. mem., dr. hab., prof. Tudor Lupaşcu, 2014-2017.</li> <li><b>11.820.08.01/BSEN/A.</b> „<i>Sharing collectively the competences of the researchers to the farmers for a sustainable and ecological exploitation of the agricultural and environment protection (ECO-AGRI)</i>”. Project manager: cor. mem., dr. hab., prof. Tudor Lupaşcu, 2013-2014.</li> </ol>				
Research contracts	2011 <b>1</b>	2012 <b>2</b>	2013 <b>3</b>	2014 <b>3</b>	2015 <b>4</b>
List of 3 representative research contracts	<ol style="list-style-type: none"> <li>Contract for consulting firms and other service providers: ”Investigation of water quality from Leova district”. <i>Beneficiary</i> – German Development Cooperation (GIZ). <i>Funding</i> - 21825 MDL, (2014).</li> <li>Contract for consulting firms and other service providers: ”Investigation of water quality from Dubasari and Criuleni districts”. <i>Beneficiary</i> – German Development Cooperation (GIZ). <i>Funding</i> - 103490 MDL (2015).</li> <li>Research contract: ”The registration of Mössbauer spectra for a number of iron compounds in solid state”. <i>Beneficiary</i> - Institute of Macromolecular Chemistry ”Petru Poni”, Iasi, Romania. <i>Funding</i> – 74416.51 MDL (2011).</li> </ol>				

#### IV. Scientific publications

Total number of publications abroad	Books <b>3</b>	Chapters in books <b>10</b>	Journal papers <b>202</b>	Conference abstracts <b>342</b>
Total number of publications in ISI journals and books	Books <b>2</b>	Chapters in books <b>3</b>	Journal papers <b>176</b>	
Total number of publications in the country	Books <b>5</b>	Chapters in books <b>3</b>	Journal papers <b>109</b>	Conference abstracts <b>338</b>
List of 5 representative publications (per	<ol style="list-style-type: none"> <li>CHISCA, D.; CROITOR, L.; COROPCEANU, E.; PETUHOV, O.; BACA, S.; KRÄMER, K.; LIU, S-X.; DECURTINSC, S.; RIVERA-JACQUEZ, H.; MASUNOV, A.; FONARI, M. From pink to blue and</li> </ol>			

accredited field)	<p>back to pink again: changing the Co(II) ligation in a two-dimensional coordination network upon desolvation. In: <i>CrystEngComm.</i>, DOI: 10.1039/c5ce01581b (IF: 4.034).</p> <ol style="list-style-type: none"> <li>2. GOLECKI, M.; BEYER, N.; STEINFELD, G.; LOZAN, V.; VOITEKHOVICH, S.; SEHABI, M.; MÖLLMER, J.; KERSTING, B. Adsorption of I<sub>2</sub> by MacrocyclicPolyaza-Dithiophenolato Complexes mediated by Charge Transfer Interactions. In: <i>Angewandte Chemie</i>, 2014, v.126, pp.10107-10111. <i>Angewandte Chemie International Edition</i>, 2014, Vol.53, pp.9949-9952 (ISSN0044-8249 (print), ISSN,1521-3757 (online)) and a fully English-language edition. <i>Angewandte Chemie International Edition</i> (ISSN 1433-7851 (print), (IF:11,336).</li> <li>3. KULCITKI, V.; HARGHEL, P.; UNGUR, N. Unusually pendant-prenylated cyclic terpenoids: from occurrence to synthesis. In: <i>Natural Product Reports</i>, 2014, v. 31, N. 12, pp. 1686-11720. ISSN 1460-4752 (IF: 10.715)</li> <li>4. PRODIUS, D.; MACAEV, F.; STINGACI, E.; POGREBNOI, V.; MEREACRE, V.; NOVITCHI, G.; KOSTAKIS, G. E.; ANSON, C. E.; POWEL, A. K. Catalytic "triangles": binding of iron in task-specific ionic liquids. In: <i>Chem. Comm.</i> 2013, 49(19), 1915-1917. 1359-7345. (IF: 6,169).</li> <li>5. LUPASCU, T.; NASTAS, R.; RUSU, V.; DUCA, G. Hydrogen sulphide removal from underground waters. In: <i>Environmental Engineering and Management Journal</i>. 2012, v. 11, nr. 3, p. 603-606. ISSN: 1648-6897 (Print), 1822-4199 (Online). (IF: 1,004)</li> </ol>
List of 5 citations	<ol style="list-style-type: none"> <li>1. JEREMIAS, F.; LOZAN, V.; HENNINGER, S.; JANIAC, C. Programming MOFs for water sorption: Amino-functionalized MIL-125 and UiO-66 for heat transformation and heat storage applications. In: <i>Dalton Transactions</i>. 2013, 42, 15967-15973. ISSN: 1364-5447. ( IF: 3,84) <b>(43 citations)</b>.</li> <li>2. NOOLE, A.; SUCMAN, N. S.; KABESHOV, M. A.; KANGER, T.; MACAEV, F. Z.; MALKOV A.V. Highly Enantio- and Diastereoselective Generation of Two Quaternary Centers in Spirocyclopropanation of Oxindole Derivatives. In: <i>Chemistry: A European Journal</i>. 2012, 18, 14929-14933. Supp. Information p. 75. ISSN 1521-3765. doi: 10.1002/chem.201203099 (IF: 5.925) <b>(33 citations)</b>.</li> <li>3. CROITOR, L.; COROPCEANU, E.; MASUNOV, A.; RIVERA-JACQUEZ, H.; SIMINEL, A.; FONARI, M. Mechanism of Nonlinear Optical Enhancement and Supramolecular Isomerism in 1D Polymeric Zn(II) and Cd(II) Sulfates with Pyridine-4-aldoxime Ligands. In: <i>The Journal of Physical Chemistry C</i>. 2014, 118, 9217-9227. ISSN: 1932-7447. (IF: 4.814) <b>(10 citations)</b>.</li> <li>4. SIRBU, D.; TURTA, C.; BENNISTON, A.C.; ABOU-CHAHINE, F.; LEMMETYINEN, H.; TKACHENKO, N.V.; WOODD, C.; and GIBSON, E. Synthesis and properties of a meso tris-ferrocene appended zinc(II) porphyrin and a critical evaluation of its dye sensitised solar cell (DSSC) performance. In: <i>RSC Adv.</i>, 2014, 4 (43), p. 22733-22742. DOI: 10.1039/c4ra03105a. (IF 3.708) <b>(9 citations)</b>.</li> <li>5. KUCHKOVA, K.I.; ARICU, A.N.; BARBA, A.N.; VLAD, P.F.; LIPKOVSKII, J.; SIMONOV, Yu.A.; KRAVTOV, V.Kh. Synthesis of nitrogen-containing drimane sesquiterpenoids from 11-dihomodrim-8(9)-en-12-one. <i>Khim. Prirod. Soedin</i>. 2011, (2), 205-210. [<i>Chem. Nat. Comp.</i>, 2011, 47 (2), 223-228. (<i>Engl. Transl.</i>)] ISSN: 0009-3130 (IF: 0.693) <b>(6</b></li> </ol>

	<b>citations).</b>
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## V. Innovation outputs

Total number of patents	Registered in the country <b>58</b>	Registered abroad <b>1</b>	Implemented <b>21</b>
Total number of new developed methods and technologies	Registered <b>0</b>	Non-registered <b>18</b>	Implemented <b>5</b>
Total number of new scientific products	Registered <b>0</b>	Non-registered <b>2</b>	Implemented <b>2</b>
List of 5 representative innovation outputs (per accredited field)	<ol style="list-style-type: none"> <li>1. Technologies of the production of activated carbon from vegetable by-products were elaborated to be used for the detoxification of human body, for treatment of waste waters, of surface and ground waters.</li> <li>2. Production of the drug Enoxil by the pharmaceuticals company CARBOLEMED SRL and distribution to all pharmacies from the country.</li> <li>3. The green technology for recycling plastic waste so as to make new products.</li> <li>4. The semi-pilot technologies for removing hydrogen sulfide and as well as divalent iron and manganese ions from groundwater.</li> <li>5. Preclinical tests of organic substances with significant tuberculostatic activity.</li> </ol>		

## VI. Other outputs

Total number of scientific outputs for central and local authorities (draft of law, strategies etc.)	<b>24</b>		
Total number of scientific outputs for educational institutions	Handbooks for higher education <b>3</b>	Handbooks for pre-university institutions <b>0</b>	Number of researchers – supervisors of license and master theses <b>12</b>

## VII. Major scientific and innovation achievements

Short description of main scientific results and their confirmation (by awards, citations, development of international projects etc.)	<ol style="list-style-type: none"> <li>1. New heteropolynuclear FeLn<sub>m</sub> coordination compounds - a new class of clusters with properties of molecular magnets were obtained.</li> <li>2. New iron coordination compounds with organic ligands that exhibit good stimulating of the biosynthesis of proteins (phycobiliproteins) properties and substances with antioxidant properties by cyanobacteria <i>Nostoc linckia</i> were obtained.</li> <li>3. The coordination compounds with stimulating the growth and development of crop plants properties were singled out. Using the obtained coordination compounds, preparations Coditiaz, Cobamid, Composite, Virinil and Conimid that can be used to create new advanced technologies were obtained.</li> <li>4. New compounds with hybrid terpenic and azaheterocyclic skeleton, which can be used to treat such diseases of fungal and bacterial nature, were obtained. The results of biological tests demonstrated that these</li> </ol>
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	<p>compounds exhibit excellent antibacterial and antifungal properties that are superior to typical existing ones for Caspofungin and Kanamycin preparations.</p> <p>5. For the first time, a biomimetic method of synthesis of diterpenoides with carbon skeleton <i>ent</i>-verrucosine A and B - biologically active compounds - activators of protein kinase C was performed.</p> <p>6. New catalysts for the tandem synthesis of regio-, diastereomerically and enantioselective oxindole compounds with inhibitory activity against integrase HIV-1 were obtained. A new monoreactor method of asymmetric synthesis of substituted spirooxindols with anti-HIV activity was developed.</p> <p>7. Ionic liquids, including magnetic one, proposed as an alternative for the classic solvents, multiple use catalysts, extragents and compounds with inhibitory activity to cancer cells HeLa were obtained.</p> <p>8. A phototransformation mechanism of some fungicides and microbiological synthesis of iron, selenium and titanium oxide nanoparticles was studied.</p> <p>9. The theory of buffer action in heterogeneous systems was developed and used for evaluation of metal remediation effects in contaminated water.</p> <p>10. New active coal-based catalysts were synthesized and the oxidation mechanism of organic and inorganic pollutants from aquatic environments was established.</p>				
Number of researchers invited as speakers at international conferences	2011 <b>6</b>	2012 <b>5</b>	2013 <b>5</b>	2014 <b>7</b>	2015 <b>10</b>
Short description of technological transfer and innovation results and their certification by implementation	<ol style="list-style-type: none"> <li>1. Technologies of the production of activated carbon from vegetable by-products were elaborated in collaboration with SRL "Ecosorbent" and implemented by specialized factory in this field from Ștefan Vodă town (Patents MD 1985, MD 3602, MD 3485).</li> <li>2. The drug Enoxil was produced by the pharmaceuticals company "CARBOLEMED" SRL and distributed to all pharmacies from the country. Patents: MD 4016 B1, MD 293, MD 3988 B1, MD 3979).</li> <li>3. The semi-pilot technologies for removing hydrogen sulfide from groundwater were elaborated and implemented in Hîncești, Water Reservoirs no. 4. (Patents: MD 4214, MD 4142).</li> <li>4. Green technology for recycling plastic waste so as to make new products was implemented at "UISPAC" SRL (Positive decision to grant a patent no. 8170 din 2015. 07.17);</li> <li>5. The technologies for processing the groundwater from divalent iron and manganese ions and humic substances were developed and implemented in Sculeni, Ungheni rayon (Patent: MD 4288 C2).</li> </ol>				
Number of defended dr./dr. hab. theses per year	2011 <b>2/0</b>	2012 <b>2/1</b>	2013 <b>3/0</b>	2014 <b>1/0</b>	2015 <b>2/0</b>

#### VIII. Present/further involvement in the Horizon 2020 (FP7):

Currently, at the Institute of Chemistry the scientific works are performed within projects:

- **FP7-PEOPLE-2013-IRSES Nr. 612484.** "NanoBioMat - Biocompatible Materials /Bioactive Nanostructured". *Project manager:* cor. mem., dr. hab., prof. Tudor Lupașcu, 2014-2017.
- **UE 2014/346-992.** "Developing of international cooperation in research of redox process of "Water Photolysis". *Project manager:* dr., conf. Vasile Lozan, 2015-2016. HORIZON 2020 "Connecting of Centres of Excellence in Moldova to the European Research Infrastructure" project.

**IX. Accredited research field and its evaluation by the National Council for Accreditation and Attestation of the Republic of Moldova (very good/good/satisfactory)**

*Synthesis, structure and properties of new polyfunctional substances; processes and technologies for environmental treatment - very good*

**X. Category (A/B/C) attributed by the National Council for Accreditation and Attestation of the Republic of Moldova to the organization**

Category A

**XI. Institutional development actions planned for the next 5 years (maximum ½ page).**

1. Creation within the Institute of a center for biological properties tests on synthesized compounds in institutional laboratories for increasing the effectiveness of research and level of exploitation of the results.
2. Optimization of the structure of Institute of Chemistry by creating the scientific centers, which will contribute to a more efficient activity of the Institute.
3. Development of the information network improving the spectral analysis database by acquisition of the programs and software.
4. Expanding the collaborations with research institutions within the country and abroad with the aim of methodology development and validation of the performed analytical methods.
5. Continuing education and training of highly qualified persons (PhD and doctor habilitate).
6. Taking of some actions towards a more active participation to the international competitions and contracting with foreign economic agents in order to win additional funds and increase the rate of special funds.