

CERTIFICATION PROGRAM

The program of the Czech Association for Applied Photocatalysis for the certification of products using the photocatalytic effect based on the evaluation of photocatalytic effectiveness and practical application according to criteria defined by the professionals in the area of photocatalysis

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I. The owner and the guarantor of the ČSAF Certification Program

The only owner and the guarantor of the program for the certification of products using the photocatalytic effect based on the evaluation of photocatalytic effectiveness and practical application according to criteria defined by the professionals in the area of photocatalysis (hereinafter referred to as the Certification Program) is the Czech Association for the Applied Photocatalysis (hereinafter referred to as ČSAF). The certificates issued based on this program are the property of the client.

The main goals of ČSAF include:

- The creation, implementation, observing, and update of the system for the qualified evaluation of photocatalytic material properties and their industrial applications,
- The creation, agreement and observing the application of the technical regulations and technical standards during the evaluation and proving the of photocatalytic material properties and their industrial applications,
- The creation of organisation and technical prerequisites for reliable testing of photocatalytic materials and their industrial applications, the issue of certificates confirming the conformance of the product properties with the defined parameters.

ČSAF completed a Certification Program to fulfil the goals.

This program is based on the latest knowledge and experience in the area of applied photocatalysis. It is inspired by the concept of PIAJ (Photocatalytic Industry Association of Japan) and it is based on the recommendations of EPF (European Photocatalytic Federation), to issue the certificates at national level which can be applied in other countries. The laboratory tests are the base for the evaluation of photocatalytic effectiveness and practical application of the products submitted for the certification. The material for the completion and the evaluation includes the existing ISO standards and the drafts of CEN standards, potentially their justified modification, provided by the science committee ČSAF.

If the existing ISO and CEN standards or their drafts and modifications do not enable efficient testing of some practically used photocatalytic effect, or in case of completely new material, ČSAF science committee can propose the test methodology for testing the effect or product based on the requirement of the ČSAF Certification Body.

The Certification Program and its potentially amendments are approved by the Board of Directors of ČSAF.

II. Goal of the certification

The main goal of the Certification Program is the protection of the consumer from the products which do not have sufficient photocatalytic effectiveness in relation to their declared practical use. Products which do not comply with the requirements of the Certification Program shall receive ČSAF certification with the confirmation of their photocatalytic effectiveness and practical application. The certificates are used for the manufacturers and sellers to prove the photocatalytic function and effectiveness of their products. The issue of ČSAF certificate confirms that the certified product is functional considering the photocatalytic effect in compliance with designated purpose.

III. Certified products

The subject of the certification includes the paint materials, concrete, ceramics, glass, textile, and potentially other materials which use the photocatalytic effect for air and water cleaning from contaminants, self cleaning of the surface, for the surface protection from the sedimentation and growth of microorganisms, and for the protection from degrading effects of ultraviolet radiation.

Subject of the certification includes the devices for air cleaning which use the photocatalytic effect for the cleaning.

IV. ČSAF Certification Body (hereinafter referred to as the Certification Body)

The application of the Certification Program in practise and the issue of the certificates is provided by the Certification Body; the members are appointed by ČSAF Board of Directors. The Certification Body decides based on the 'Criteria for certification' as defined in this document.

V. Test laboratories

The main material for the evaluation of photocatalytic effectiveness and practical application of the products using the photocatalytic effect are the protocols from the laboratory tests completed based on technical standards recommended by the science committee of ČSAF and approved by ČSAF Board of Directors.

Testing according to the approved technical standards is performed by the test laboratories equipped with suitable analytic technology, qualified employees, and other required technical devices verified and approved by ČSAF.

The list of test laboratories verified and approved by ČSAF including the review of provided tests:

1. VŠCHT–Josef Krýsa

Air-purification performance of semiconducting photocatalytic materials:

- *ISO 22197-1:20016 Air-purification performance of semiconducting photocatalytic materials – removal of nitric acid*

- *ISO 22197-3:2011 Air-purification performance of semiconducting photocatalytic materials – removal of toluene*
- *ISO 22197-2:2011 Air-purification performance of semiconducting photocatalytic materials – removal of acetaldehyde*
- *ISO 22197-4:2013 Air-purification performance of semiconducting photocatalytic materials – removal of formaldehyde*
- *Photocatalytic purification of hexane during continual and agitated mode with the evaluation of complete mineralisation (CO₂ formation) according to VŠCHT testing.*
- *Photocatalytic activity of self-cleaning surfaces*
 - *ISO 27448:2009 Test method for self-cleaning performance of semiconducting photocatalytic materials - Measurement of water contact angle*
 - *ISO 10678:2010 Determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue*
 - *UNI 11259 Determination of the photocatalytic activity of hydraulic binders rhodamin B test method*
- *ISO 27447:2009(E) Test method for antibacterial activity of semiconducting photocatalytic materials*
- *ISO 21066:determination of photocatalytic activity of sled-cleaning surface using Resazurin ink*
- *CEN 16846-1:2017 Determination of photocatalytic efficiency of air purifiers using mixture of 4 compounds (acetaldehyde, toluene, acetone, heptane or hexane), concertation of each compound 1 ppm. Measuring of produced CO₂*

2. ÚFCH JH AV ČR – Jiří Rathouský, Jaromír Jirkovský

Air-purification performance of semiconducting photocatalytic materials:

- *ISO 22197-1:2007 Air-purification performance of semiconducting photocatalytic materials – removal of nitric acid*
- *ISO 10678:2010 Determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue*
- *Specification of photocatalytic activity of surface in water environment – purification of 4-chlorophenol with the evaluation of degradation intermediate products*
- *Specification of photocatalytic activity of surface in water environment – purification of methylene blue (own method)*

- Specification of photocatalytic activity of surface in water environment – purification of antibiotics (own method)
- Specification of photocatalytic activity of surface in water environment – purification of rhodamin B (own method)

3. VUT Brno – Michal Veselý

- ISO 27447:2009(E) Test method for antibacterial activity of semiconducting photocatalytic materials

4. VŠB-TUO – Kamila Kočí

Air-purification performance of semiconducting photocatalytic materials:

- ISO 22197-1:2007 Air-purification performance of semiconducting photocatalytic materials – removal of nitric acid

5. TUL

Air-purification performance of semiconducting photocatalytic materials:

- ISO 22197-1:2007 Air-purification performance of semiconducting photocatalytic materials – removal of nitric acid, (joint facility NANOPIN)
- Evaluation of air purifiers – modified test according to EN 16846 -1 : 2017 (evaluation of air purifiers according to CEN (so far modified test). Complete test can be agreed in CERTECH

Photocatalytic activity of self-cleaning surfaces

- ISO 10678: 2010 Self-cleaning- ISO method for the purification of MB

Antibacterial activity of photocatalytic active surfaces

- ISO 27447: 2009 microorganisms ISO method for bacteria

Antialgae activity of photocatalytic active surfaces

- ISO 19635: 2015 method for the determination of algae death loss
- Specification of photocatalytic activity of self-cleaning surfaces – inks according to ISO draft
- The evaluation of photocatalytic surface life – ageing according to the draft of CEN test

Accurate procedures and system for the test evaluation form a part of every test protocol/ report.

Note: Accurate wording of standards and test methods of ČSAF is not officially stated due to intellectual protection property, however it can be purchased or received from authorised sources.

VI. Certification rules

General conditions

1. The applicant automatically becomes the owner after the issue of ČSAF certificate. The certificate becomes valid after the fulfilment of all financial and technical requirements defined in the Certification Program. If the certificate is issued under specific conditions, the certificate holder undertakes to fulfil the conditions for the defined period.
2. the Certification Body evaluates the documentation, decides on the certificate award, and resolves potential objections related to the certification.
3. The complaints considering the Certification Body are sent by the certification applicants to the Certification Body; it will then proceed according to the documented procedures for the compliant settlement defined in article X. of the Certification Program.
4. The complaints considering the certificate holder are sent by the complainant to the Certification Body which adequately proceeds according to the procedures defined in article X. of the Certification Program.
5. The certificates relate to the specific product properties verified according to respective criteria, requirements, and technical procedures defined in the Certification Program, and they are not transferable.
6. The Certification Body shall issue the certificate if the products fulfil the technical requirements and other matters defined in the Certification Program and are valid at the time of the certificate issue.
7. If the certificate and other related documents are in the paper and in the data form, ČSAF shall submit to the applicant also the data form of the documents. The certificate issued in paper form is a legally binding document.
8. If the certificate validity is terminated due to any reason, the validity of the respective order/ contract used for the certificate issue is also terminated.
9. All charges unpaid by the applicant are still due in case of the order/ contract withdrawal, and all costs of the Certification Body in relation to the certification can be invoiced.
10. The termination, removal, restriction, and interruption of the certificate validity
 - a. The certificate becomes invalid or is considered removed if:
 - The defined validity period terminated,
 - The certificate holder terminated the business activity,
 - The certificate holder changed the product title,
 - The updated certificate was issued, e.g. in case of changes in the technical standard or technical specifications used for the certificate

issue, and if the certificate holder proved repeated testing within adequate period, completed at own costs, for the product compliance with new requirements.

b. The Certification Body can remove the certificate without the notification or declare it invalid, if:

- Misleading or unauthorised advertising is applied, particularly in relation with the certificates, in case of certificate misuse, or in case of incompliance with legal conditions during the product introduction on the market, or if the certificate holder tolerates such misuse.
- The certificate holder is in delay with the payment for ČSAF exceeding 4 weeks after the notice. Incomplete payment results in the unpaid certificate removal,
- In case of ISO standard update, when the Certification Body considers the tested product incompliant with the standards, or their valid changes or new issue, even within adequate deadline, which enables the certificate holder to adapt the product or system to changes, and it failed to do so.
- The certificate holder violates the conditions approved in the certificate,
- The certificate holder provides ČSAF with untrue information or hides facts related to the certification.
- Additionally finds out the certificate holder does not fulfil the certificate validity conditions from the certificate issue.

c. The Certification Body is not entitled to publish the details on the removal, terminated validity period, the restriction and interruption of the certificate validity. The certificate holder cannot continue in these cases in advertising or other use of the certificate or ČSAF in relation to the issue. The certificate is invalid and must be immediately returned to the Certification Body, or destroyed upon the instruction of the Certification Body.

d. ČSAF is not responsible for potential disadvantages for the certificate applicant or the holder resulting from failed issue, removal, terminated validity, restriction, and interruption of the certificate validity.

11. Conditions for the certificate issue

- Filing a complete application for the product certification,
- Confirmation of binding order/ contract for the product certification,
- Submitting the laboratory test protocols with the product properties completed according to respective criteria, requirements, and technical procedures defined in the Certification Program, and completed test laboratories verified and approved by ČSAF,

- Proving the product properties if the certification applicant owns the laboratory test protocols and potentially other documents before filing the application, with the content of data on the product properties subject to the application, and the tests were completed by the laboratory not verified and approved by ČSAF, or the test completion differs from the criteria, requirements, and technical procedures defined in the Certification Program. The Certification Body, based on professional evaluation of the applicant's documents, individually assesses the approval. If the submitted documents are not approved, the certificate cannot be issued.

The Certification Body will individually focus on laboratory protocols and other materials issued by other than ČSAF verified and approved workplaces solely in cases:

- The product has been on the market longer than 24 months (confirmed by the references), and they were issued based on tests performed prior to the ČSAF certification start,
- ČSAF has no verified and approved laboratories for the properties testing and test types,
- The same properties have been proven by means of the same tests but in another laboratory, which can complete such tests (e.g. abroad).
- The conformance of the product properties recorded by the laboratory test protocols, verified and approved by ČSAF, or other documents accepted by the Certification Body with the requirements defined in the Certification Program,
- Confirmation of principles for the use of ČSAF certificate,
- Payment of the contractual price for the product certification.

Technical conditions for the product testing and certification

1. Testing

The certification can utilise solely the product tests completed by the test laboratory verified and approved by ČSAF for the test completion of photocatalytic effects of the products. The test result protocols form an obligatory annex to the 'Product Certification Application' delivered by the applicant to the Certification Body as material for the certificate issue.

The test protocols completed by other laboratories and other materials including the demonstration in practice, can be acknowledged solely in cases defined in the Certification Program. If the Certification Body does not accept the protocols, the applicant can test the product in the laboratory verified and approved by ČSAF.

2. Certificates

Based on positive evaluation of all required materials, including the test results and their conformity with the requirements defined in the

Certification Program, ČSAF shall issue the certificate and record the product in the registry of ČSAF certified products.

The certificate is valid solely for the specific certified products and their manufacturers (potentially the seller). The certificate is not transferable by the holder to third persons or other products.

3. The types of certificate for the declared properties (functions) will be issued as compliant or in compliance according to the products effectiveness.

The criteria for the effectiveness determination are defined in table 'Certified properties of photocatalytic products, test types for testing the specified properties and the evaluation criteria for the products according to the test results' (chapter VII. Certification Program)

4. Term of the Contract validity

The certificate validity period is not limited if the product design, its properties and the production process do not change in matter which would affect the product technical parameters defined in the respective Certification Program used for the product certification. If such change occurs, the certificate holder must immediately report the fact to the Certification Body, together with the technical data, and the Certification Body shall assess the certificate validity. The Certification Body can request further technical data for the decision on the certificate validity.

If the Certification Body comes to the conclusion that the product properties are not affected by the change, it conforms the certificate validity, this fact will be notified to the holder and recorded in the register of certified ČSAF products.

If the certified body comes to the conclusion that the product certified properties are affected and do not comply with the technical requirements defined in the Certification Program subject to the product certification, the certificate validity will be terminated.

If the certificate holder does not submit technical data within two calendar months from the date requested by the Certification Body, the Certification Body will terminate the certificate validity after the deadline. The certificate body will report the certificate validity termination in writing to the holder. The product will be eliminated from the registry of certified ČSAF products.

VII. Certified properties of photocatalytic products for declared function and application based on the results of ISO and CEN standards, and the product evaluation criteria according to the results of standard tests

product	property	Standard	Evaluation criterion for effectiveness		note
			compliant	excellent	
Paint, concrete, ceramics, glass, and other materials	Air purification from NOx	ISO 22197-1:20016	>2 μmol	>5 μmol	Measuring as per the standard
	Air purification from VOC - toluene	ISO 22197-3:2011	>0,20umol/h	>1umol/h	Measuring as per the standard
	Air purification from VOC – acetaldehyde	ISO 22197-2:2011	>0,7umol/h	>1,4umol/h	Measuring as per the standard
	Air purification from VOC – formaldehyde	ISO 22197-4:2013	>0,20umol/h	>1umol/h	Measuring as per the standard
	Self cleaning of surface – methylene blue	ISO 10678:2010	Specific degradation rate >14μmol/hour/m2, alternatively absorbance decrease >20% after 3 hours	Specific degradation rate >22μmol/hour/m2, alternatively absorbance decrease >30% after 3 hours	Measuring as per the standard
	Self cleaning of surface (water angle)	ISO 27448:2009	>water contact angle 30° degrees	>water contact angle10 degrees	Measuring as per the standard
	Self cleaning (reduction of Resazurin ink)	ISO 21066:2018	Ttb in the range 4-45 min	Ttb in the range (1,5-4)	Measuring as per the standard
	Self cleaning (degradation of Rhodamine B)	UNI 11259	color change higher 25% after 4 hours, or color change higher than 50% after 26 hours	Color change higher than 30% after 1 hour, or color change higher than 50% after 4 hours	Measuring as per the standard
	Antibacterial activity	ISO 27447:2009(E)	Reduction CFU>99.9% ,R>2	Reduction CFU >999,9% ,R>3	Measuring as per the standard
	Antiviral activity	ISO 18061:2014 ISO 21702:2019	Antiviral (virus reduction >99%)	Virucidal (virus reduction >99.99%)	Measuring as per the standard
	antialgae activity	ISO 19635:2015(E)			<i>Will be specified</i>
	water cleaning	CEN (WI 386020}			<i>Will be specified</i>

	safety	accredited tests of mechanical properties, testing of dustiness	Parametres according to specific standards		<i>Will be assessed individually according to the standards for mechanical properties of products</i>
Air purifier	The evaluation of effectiveness for the degradation of 4 compound (acetaldehyde, acetone, toluene and heptane or hexane). Initial concentration of each compound 1 ppm. Measuring of produced CO ₂	CEN 16846-1:2017	>Purification of 90% substance/ 24h for	>Removal of 90% substance/ 4h for the the declared air volume	Measuring as per the standard

Notes for the function evaluation of photocatalytic products according to table:

1. *It is based on the completion of ISO or CEN standard tests. The reason is the compatibility and approval of ČSAF certificates worldwide.*
2. *The criteria for the effectiveness evaluation, i.e. the product is assessed as compliant, were accepted particularly based on cooperation with PIAJ. This organisation is experienced and as the first (and so far the only) introduced the Certification. PIAJ does not cover all products, does not use CEN tests and uses low values for air purification from NOx. The clarifications below were completed:*
 - a) *The effectiveness of the photoactive surface for Nox removal – conformity with FACH experts that PAJ values (i.e. 0.50 umol) are too benevolent (*NOx removal test, is per test piece (50 cm²) for 5 h (~0.1 mmol/m²/5h). This amount corresponds to average removal of 1.25% (total NOx feed is 40 umol during 5 h test period)). The surface with this effectiveness cannot contribute to air purification.*
 - b) *Self-cleaning properties of porous surfaces is difficult to evaluate. Considering the problems related to the testing of some types of photoactive materials on the porous surfaces using the ISO method result in incorrect interpretation. If the effects of MB removal are evaluated by means of photonic efficiency, the digit form of photocatalytic effectiveness is not used and the percentage value of MB removal is applied. Self-cleaning properties require the minimum value of MB removal compliant with 10% value.*
 - c) *The effects on the self-cleaning properties according to MB must resemble practical applications when porous materials are measured. The removal of MB can be used as a result*
 - d) *The effects of photoactive surface on anti-algae will be defined after the consulting with PIAJ. Only Japan and TUL workplace is able to measure according to ISO standard, and it is necessary to reach the conformity as soon as possible.*
 - e) *If the effects of photoactive surface is evaluated according to new ISO standard, it is necessary to reach the consensus regarding the result acceptable for the functional product*
 - f) *The effects of the air purifier must be assessed considering the declared volume of clean air (small purifiers in the fridge, large for the living room) and also based on correct function by measuring free CO₂ (it shows different technology and correct construction)*

Note: Depending on the situation on the market, ČSAF needs, and the approval of new ISO and CEN methods, the table will be updated. For the purposes of Czech market, ČSAF may consider the approval of other tests, if completed.

VIII. Filing the application for the certification and the list of documents required for the certification completion

1. completed and signed application for the product certification,
2. The record from the business registry and another registry proving the existence of the applicant and its statutory representative (members of ČSAF must not submit it).
3. Declaration of the applicant for the relationship to the certified product (inventor, manufacturer, distributor-seller).
4. Technical specification of the certified product (e.g. technical data sheet) and the related technical documentation.
5. required data on the product safety based on legal standards (acts, regulations) (safety data sheet updated according to the valid regulations).
6. Documents issued by the test laboratories in relation with the tested photocatalytic properties of the certified product (protocols, test reports, assessments, etc.).
7. If the applicant requires the approval of the documents issued by the test laboratories which are not verified and approved by ČSAF, it is necessary to add justification to the documents for the submission and the reason for the approval.
8. Verifiable references of practical application of the certified product.
9. Signed order/contract.
10. Signed confirmation with 'The principles for the use of ČSAF certificate'.

IX. Pricelist for the tasks

1. Extra payment for the submission of the certification application – for every certified property (air purification, self-cleaning, antimicrobial property, UV protection, water decontamination): 15.000 CZK (members 5000 CZK)
2. the evaluation of document applicability issued by other than ČSAF accredited laboratories (experts) – for every submitted document: 7.000 CZK (for the members of ČSAF with the documents created before starting the certification system ČSAF: 1,000 CZK).
3. The prices for the laboratory tests are defined by the test laboratories.

X. Procedure for the application filing on the certification and the actual certification

1. The applicant for the certification will read about the Certification Program of ČSAF and its conditions on the web pages of ČSAF.

2. The applicant will complete all documents required for the filing of application and the certification completion. The completion is the provision of the required tests, protocols, and test reports by the test laboratories.
3. The applicant shall file the application with all required annexes to the Certification Body.
4. The Certification Body shall evaluate the application and if it fulfils the matters defined in the Certification Program, it will submit the order/contract to the applicant for the certification completion. The applications which do not fulfil all matters will be returned to the applicant.
5. The applicant shall return one copy of signed order/ contract to the Certification Body and pay the contractual fee for the certificate issue.
6. The Certification Body shall issue the certificates for the products fulfilling the conditions defined in the Certification Program.

XI. The rules for the complaint considering the decision of the Certification Body

1. The applicant shall file the appeal against the decision on negative result of the certification to the Certification Body.
2. The deadline for the appeal is 30 days from the delivery of the decision on the negative result of the certification to the applicant.
3. The appeal sent by mail or delivered in person by the applicant's representative is registered by the Certification Body and immediately passed to the Certification Body manager (VCO) for settlement.
4. The appeal has immediate effect.
5. VCO will confirm the reception of the appeal within 15 days with the notification of deadline for settlement.
6. If VCO comes to the conclusion that the appeal is adequate, he/she will accept it, and comply with the applicant. The appealed statement will be revoked within 30 days, and complete all changes in the documents to rectify the errors. The result will be notified by VCO in writing to the applicant, and the appeal is considered completed.
7. If the complaint was not filed within the defined deadline or it cannot be settled, VCO must negotiate with the applicant's representatives prior to the issue of negative statement. The goal of the negotiation is to clarify to the applicant the point of the negative decision and to reach the consensus in opinions. This negotiation must be completed within 30 days, i.e. before the deadline for the complaint settlement.
8. If consensus is not reached during the meeting of VCO with the applicant's representative, the complaint and the statement of VCO will be passed to the ČSAF, Board of Directors which will accept definitive decision within

the appeal matter. The decision of ČSAF Board of Directors is final. The applicant will be notified in writing.

XI. Annexes to the Certification Program

1. Certification application
2. Order/contract
3. Principles for the use of ČSAF certificate
4. The list of standards and the test procedures for the certification photocatalytic products used by the laboratories verified and approved by ČSAF.